VOLUME XLIV
NUMBER SIX

THE NATIONAL GEOGRAPHIC MAGAZINE

DECEMBER, 1923

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With 4 Illustrations — J. HOWARD GORE

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TO carry out the purposes for which it was founded thirty-five years ago, the National Geographic Society publishes this Magazine. All receipts are invested in the Magazine itself or expended directly to promote geographic knowledge.

ARTICLES and photographs are desired. For material which the Magazine can use, generous remuneration is made. Contributions should be accompanied by an addressed return envelope and postage.

IMMEDIATELY after the terrific eruption of the world's largest crater, Mt. Katmai, in Alaska, a National Geographic Society expedition was sent to make observations of this remarkable phenomenon. Four expeditions have followed and the extraordinary scientific data resultant given to the world. In this vicinity an eighth wonder of the world was discovered and explored—"The Valley of Ten Thousand Smokes," a vast area of steaming, spouting fissures. As a result of The Society's discoveries this area has been created a National Monument by proclamation of the President of the United States.

AT an expense of over $50,000 The Society sent a notable series of expeditions into Peru to investigate the traces of the Inca race. Their discoveries form a large share of our knowledge of a civilization waning when Pizarro first set foot in Peru.

THE Society also had the honor of subscribing a substantial sum to the expedition of Admiral Peary, who discovered the North Pole.

NOT long ago The Society granted $25,000, and in addition $75,000 was given by individual members to the Government when the congressional appropriation for the purchase was insufficient, and the finest of the giant sequoia trees of California were thereby saved for the American people.

THE Society is conducting extensive explorations and excavations in northwestern New Mexico, which was one of the most densely populated areas in North America before Columbus came, a region where prehistoric peoples lived in vast communal dwellings and whose customs, ceremonies, and name have been engulfed in an oblivion.

THE Society also is maintaining expeditions in the unknown area adjacent to the San Juan River in southeastern Utah, and in Yunnan, Kweichow, and Kansu, China—all regions virgin to scientific study.

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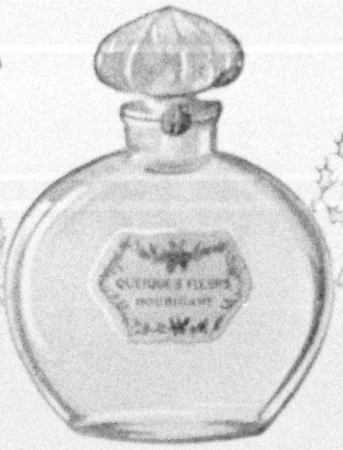

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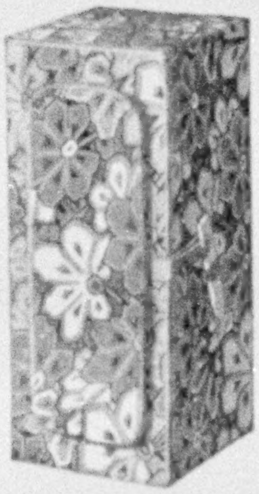

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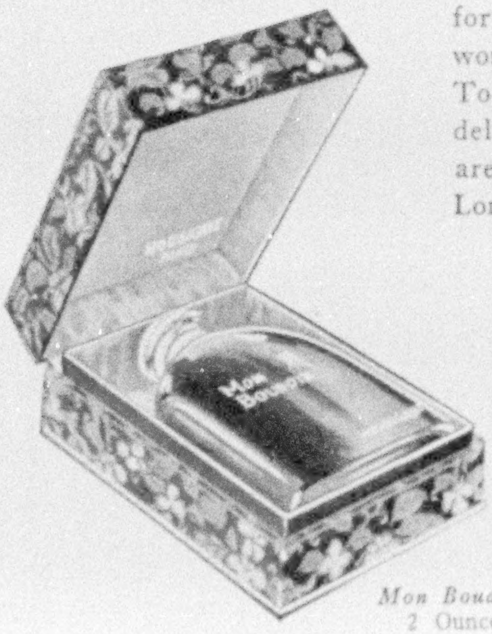

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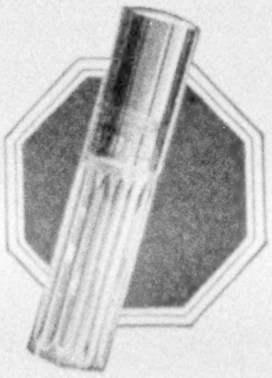
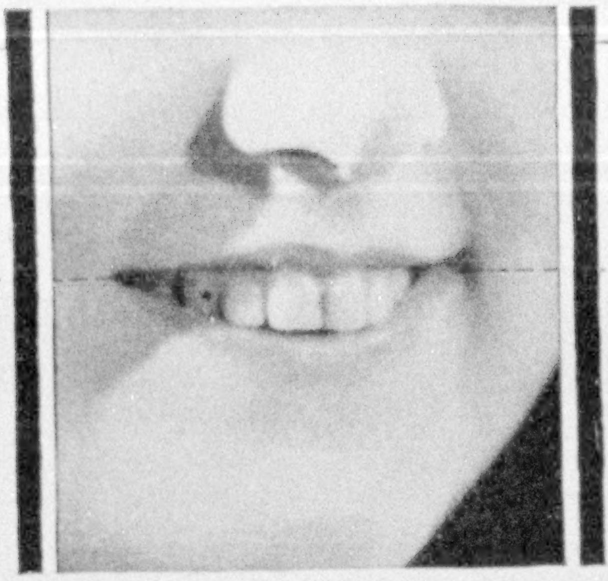


FOR REMEMBRANCE

A fascinating trifle with which to send greetings on Christmas Day is this golden-capped HOUBIGANT scent bottle for the purse. Choice of fourteen of the famous HOUBIGANT odeurs. Price, one dollar.



Receding gums expose
THE DANGER LINE
on your teeth

Where Acid-Erosion causes decay, pyorrhea and many serious dental troubles

DO you ever notice that your gums become inflamed and swollen at times? This is a warning that you should heed. It is often caused by trouble at The Danger Line—where teeth meet gums.

The hard, protective enamel on your teeth stops there. Below it is a sensitive, soft, bony structure that decays easily.

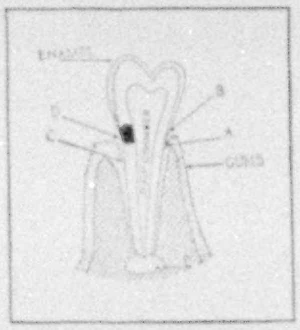
A little triangular pocket

The edges of your gums do not cling flush to the surface of your teeth. They are rounded and form a little V-shaped crevice.

Tiny food particles are forced down into this crevice when you eat. They cause irritation and inflammation, which results in a gradual recession of the gums, exposing The Danger Line.

These food particles ferment and acids are formed which eat into your teeth. This is Acid-Erosion—the forerunner of decay and pyorrhea.

Once decay reaches the soft, bony structure of the teeth it spreads rapidly. Infections arising from these conditions often result in toxins that are absorbed into the system and may be responsible for serious illness.



Sectional drawing of an ordinary tooth and gums

"A" is The Danger Line. "B" is the V-shaped crevice. "C" shows recession of gums. "D" is decay at The Danger Line. Abscesses form at "E."

You cannot have sound teeth or perfect health unless Acid-Erosion is stopped at The Danger Line.

Squibb's Dental Cream stops Acid-Erosion

Brushing your teeth with Squibb's Dental Cream is a safe and positive preventive for Acid-Erosion. This remarkable new dental cream is made with Squibb's Milk of Magnesia—for years recognized by dentists and physicians alike as the ideal antacid. It gets into crevices that your tooth-brush cannot reach, preventing decay. It gets into the gum-pockets at The Danger Line, neutralizing all acids there and protecting teeth and gums from disease.

Squibb's Dental Cream also cleans the teeth thoroughly, removing stained dental mucin and keeping the teeth as clear, bright and attractive as nature intended them to be. You will like its pleasing flavor and the delightful clean taste it leaves in your mouth.

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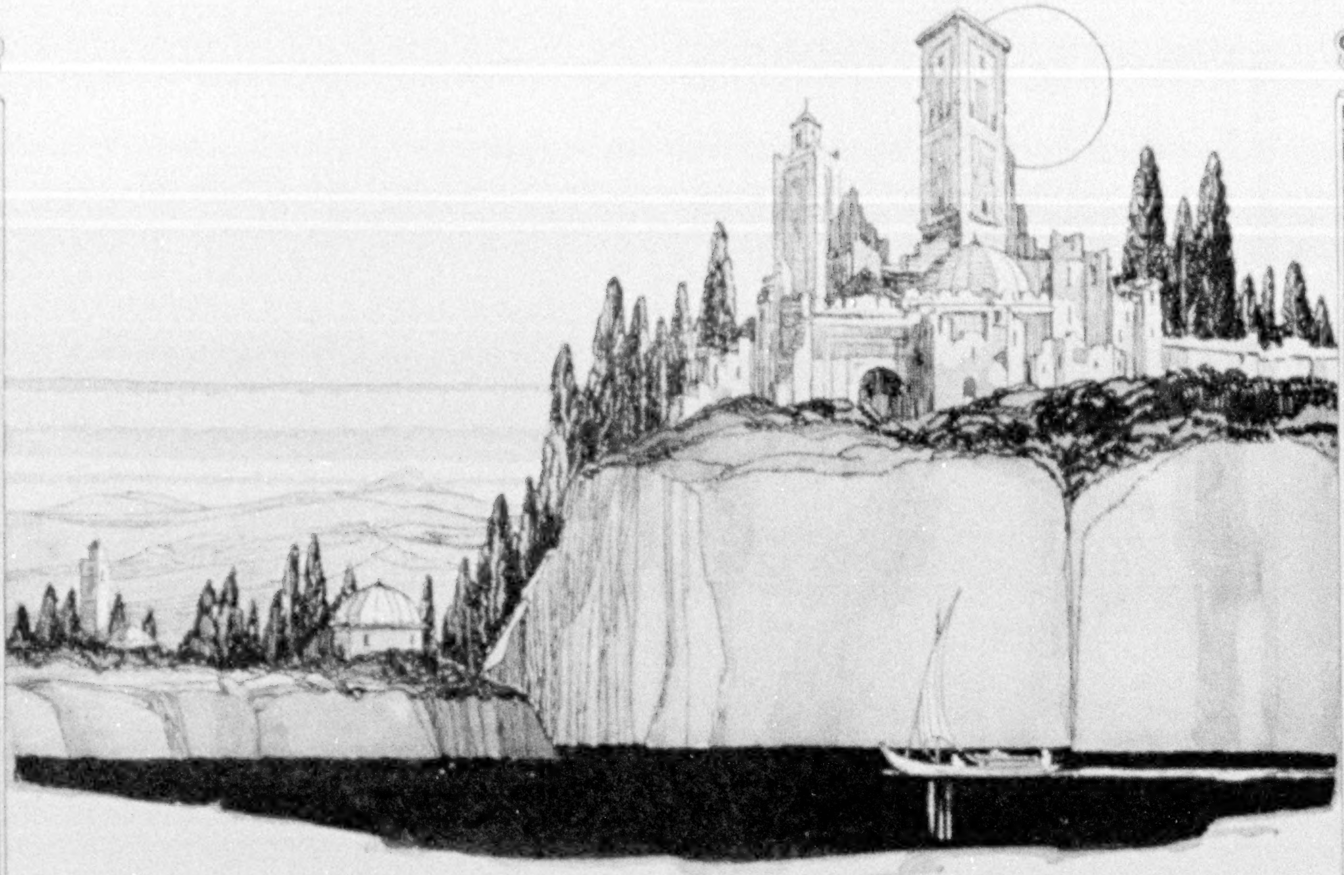

Across the Blue Mediterranean Lies the Garden of Allah

ONE day's sail from France lies the last great stronghold of the Prophet's power—the Mohammedan paradise of North Africa.

There days are warm and the nights are cool—a land of fig trees, date palms and orange groves—of flower scented gardens and soft African air—of slumberous Moorish cities still living in the twilight of Islam—of dead Roman and Carthaginian cities—of sunlit wastes and vividly green oases in the Sahara—of strange oriental peoples and customs.

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Extremely interesting literature further detailing these tours may be had by writing to the nearest French Line office—or 19 State Street, New York.

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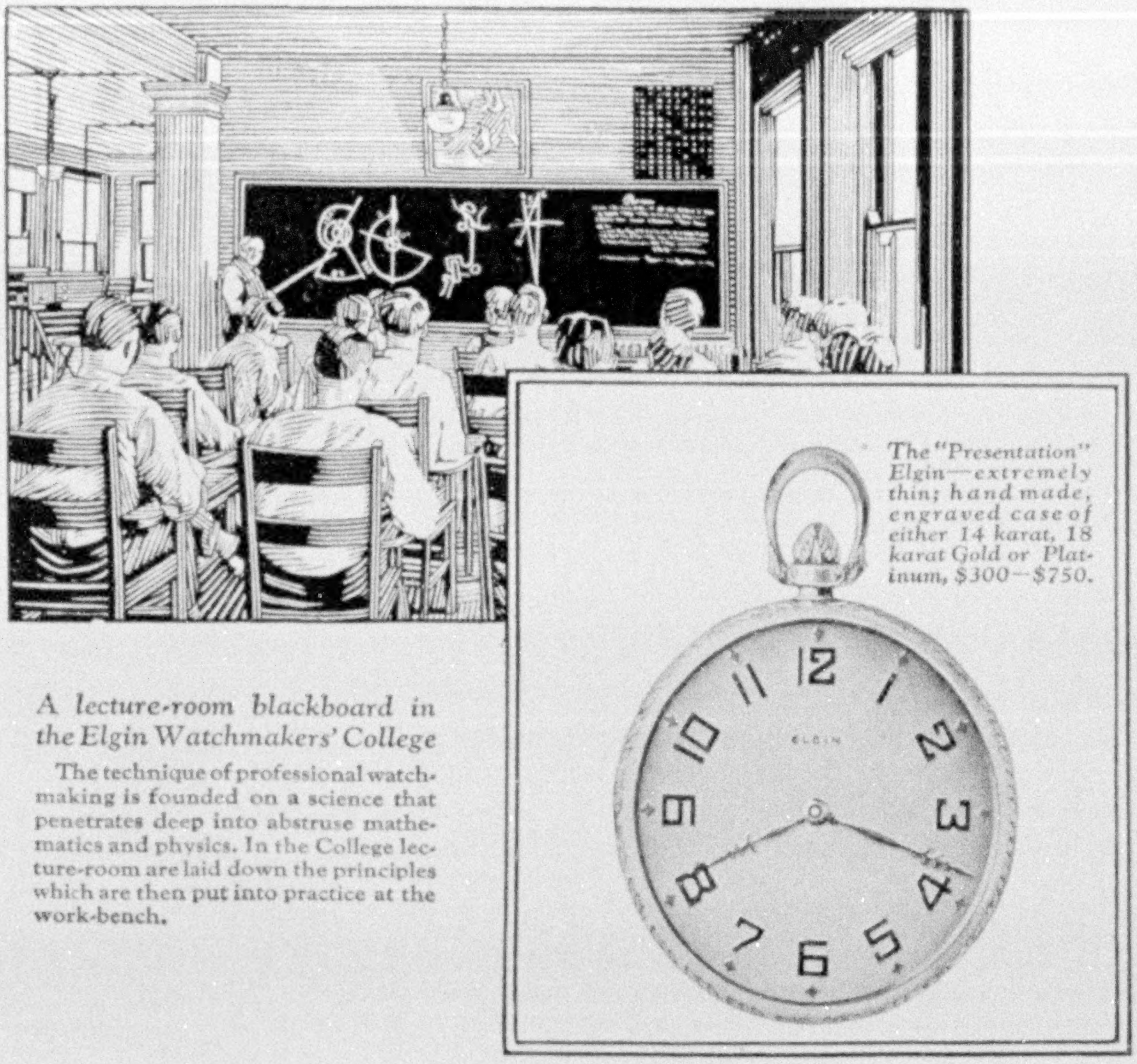

The "Presentation" Elgin—extremely thin; hand made, engraved case of either 14 karat, 18 karat Gold or Platinum, $300—$750.

A lecture-room blackboard in the Elgin Watchmakers' College

The technique of professional watchmaking is founded on a science that penetrates deep into abstruse mathematics and physics. In the College lecture-room are laid down the principles which are then put into practice at the work-bench.

Elgin looks way beyond 1923

The Watchmakers' College does that

ELGIN service through the jeweler has been celebrated for years. In scope and care it ranks first and Elgin users have been getting the benefit of it right in their own home town for a long time. But today the Elgin vision goes still further.

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So in 1920 the Elgin Watchmakers' College was established and endowed.

Here, studying for as many as four years under teachers of international reputation, are young men from all over the nation who have an instinctive regard for fine mechanisms and delicate handwork. Here, too, are experienced watchmakers and time inspectors who have come to the college for a year's intensive study to perfect themselves still further.

These men will know watches and love watches. From their Watchmakers' College they will bring their service to you and look after your watch in the same professional spirit that shows itself in making an Elgin Watch.

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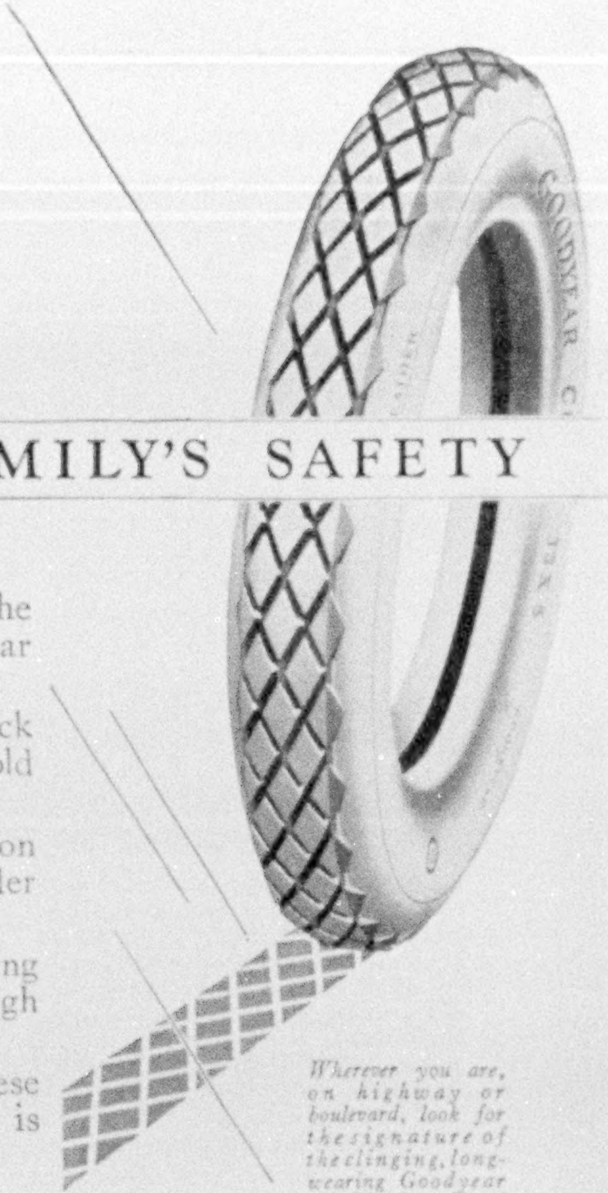
INSURING YOUR FAMILY'S SAFETY



Wherever you are, on highway or boulevard, look for the signature of the clinging, long-wearing Goodyear All-Weather Tread

No motorist who has felt the security of the Goodyear All-Weather Tread under his car needs to be told its special advantages.

He knows how firmly, how surely, the big, thick keen-edged blocks of this great tread take hold on any surface.

He knows how powerfully they put traction under the drive of the engine, and safety under the pressure of the brake.

He knows how stubbornly they clutch and cling on slippery streets or roadways, digging through to solid footing and a safe stop.

The Goodyear All-Weather Tread does these things incomparably well simply because it is scientifically designed to do them.

Its blocks are made wedgelike, so shaped as always to present right-angled resistance to the direction of skidding; they are self-cleaning, for continuous efficiency.

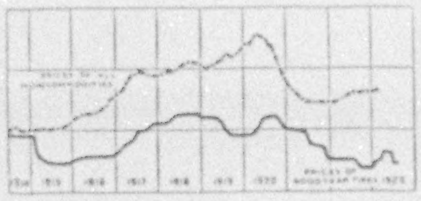
On the *new* Goodyear Cord Tire the All-Weather Tread now is made from an extraordinarily dense and enduring rubber compound, affording even longer wear.

Its deep-channeled symmetrical pattern combines the utmost in economy with maximum tractive power.

For your own and your family's safety you ought to have All-Weather Tread Goodyears on your car.

Costing no more than other good tires, they are one of the best forms of insurance you can have.

A GOOD TIME TO BUY GOODYEARS



Over the past ten years Goodyear Tires have been steadily improved. Despite this, prices on Goodyear Tires have consistently been kept below the average price level for all commodities, as the above chart shows. Although Goodyear Tires today are better than ever before, Goodyear prices are 37% below those of 1920, and 30% below those even of 1914. This is a good time to buy Goodyears.

Goodyear Means Good Wear

GOODYEAR

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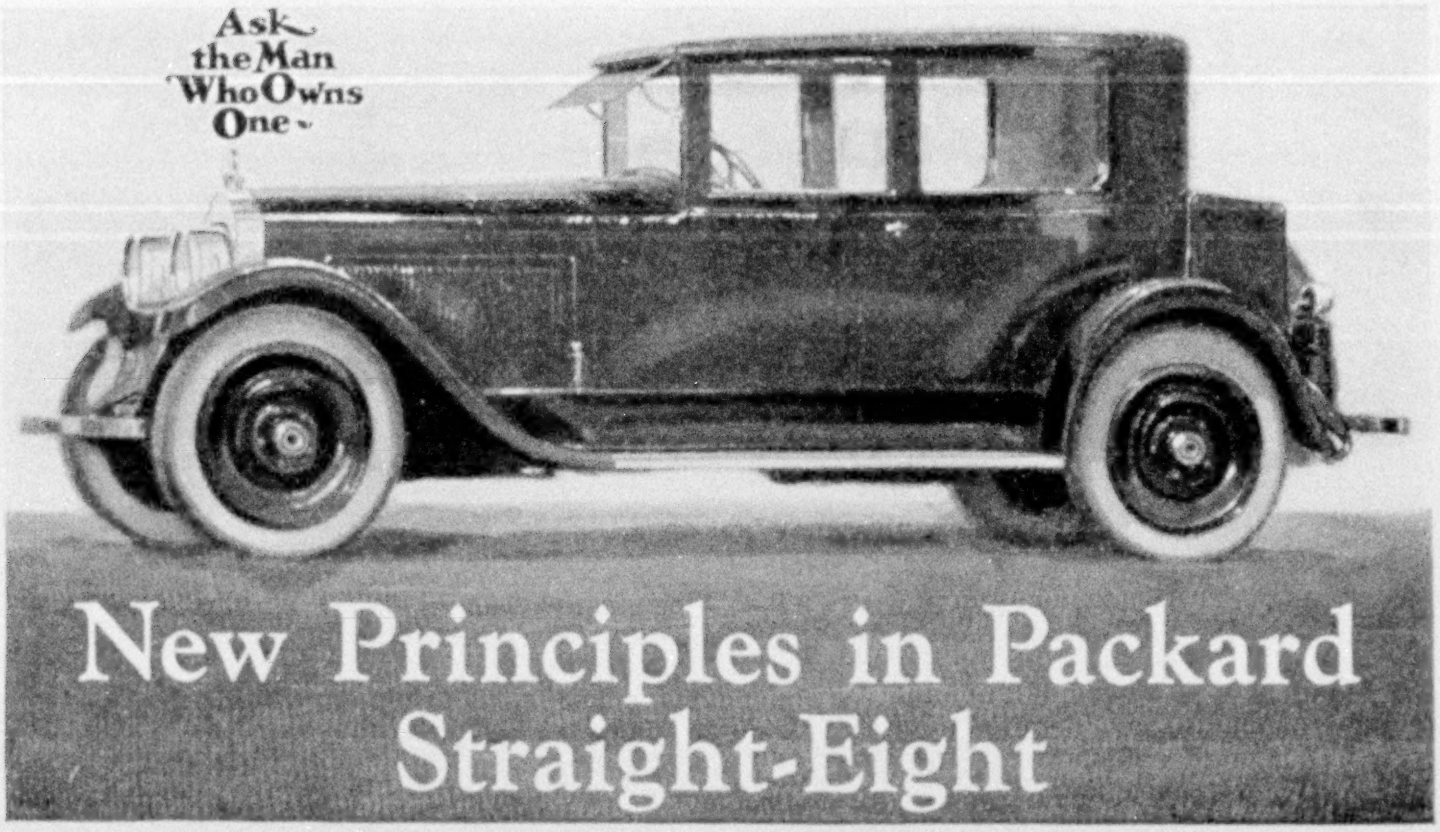


New Principles in Packard Straight-Eight

What They Are and What They Mean

The performance which lifts the new Packard Straight-Eight out of any possible competition with any other car, either domestic or foreign, is the result of new engineering principles.

It is a fair question, therefore, to ask the nature of these principles and what are the qualities of performance they give the man who seeks the finest type of motoring.

First of all, the Packard Straight-Eight differs in design from all other eight-cylinder cars.

The new engineering principles applied in its construction include a scientific readjustment of power distribution. This is accomplished by a new combination of cylinders and a new firing order that bring the eight cylinders into a single unit of power.

The result is perfect harmony. There is a balance of power not found in any twin-four or tandem-four.

They also include a new crankshaft design which gives power smoothness, motor rigidity and durability.

There are nine crankshaft bearings and the greatest distance between bearings does not exceed 2¼ inches.

All the complications of the V-Type motor have been eliminated and all the simplicity of the Single-Six, companion car to the Straight-Eight, retained.

By reason of these new ideas the power unit weighs 350 pounds less than that of the Twin-Six which the Straight-Eight supplanted and it is possible to make the unqualified statement that—

Bear in mind that the new Packard Straight-Eight has a score of important features that make it the greatest of all Packards. When you examine it note these: the exclusive Packard Four-Wheel Brakes; the exclusive Packard Fuelizer which speeds up acceleration, reduces the warming-up period and contributes to fuel economy; a steering gear with the minimum of friction and which automatically straightens the car out of a turn; a three-fold lighting system; completeness of equipment.

Never before has there been a motor of such perfect co-ordination of all reciprocating and rotating parts.

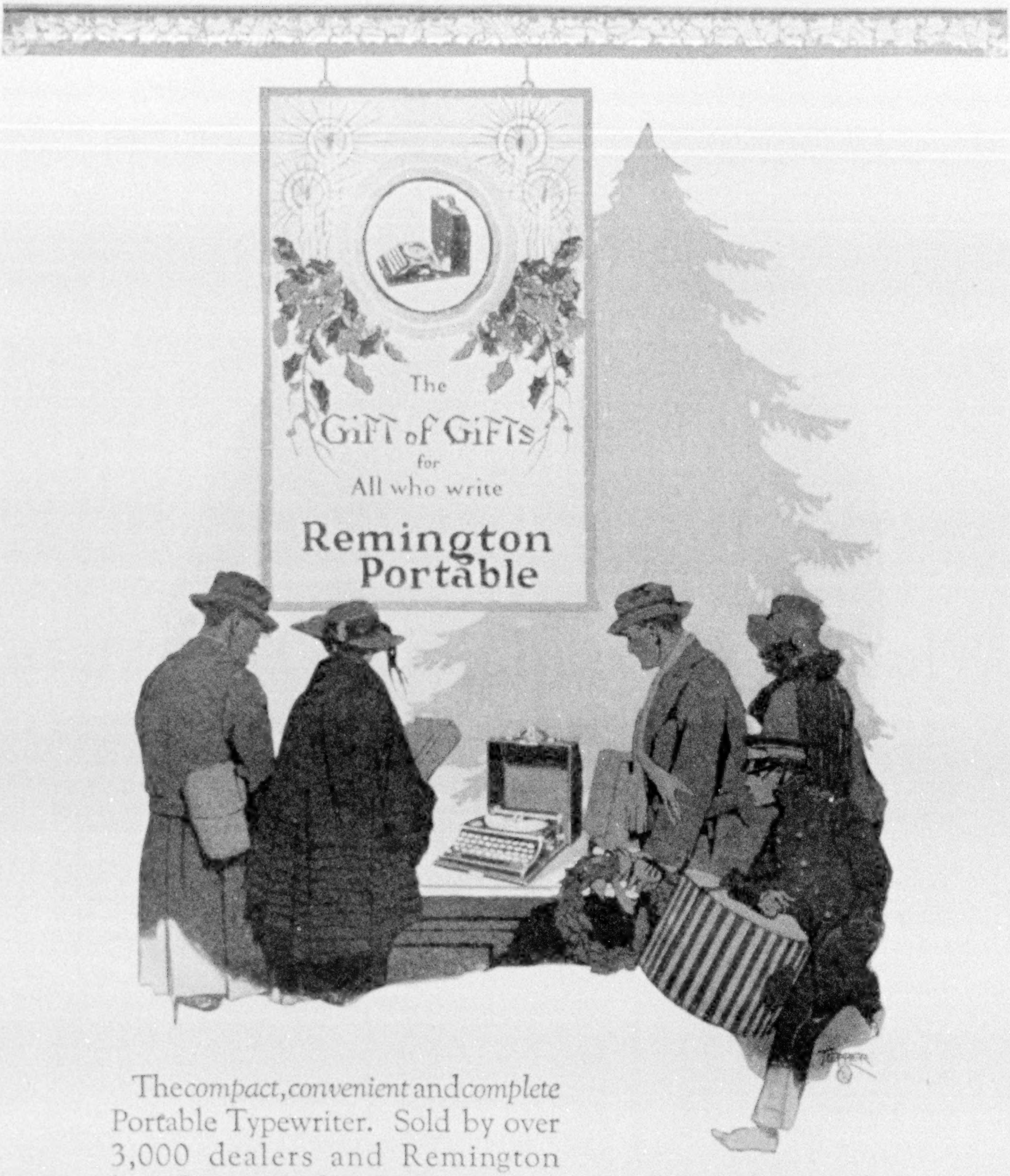
The effect of these new ideas of design on the power flow is nothing short of magical. It must be experienced to be understood. Were we to attempt to describe it we could compare it only to the flow of an electric current.

Combined with this truly indescribable smoothness in the silent flow of a seemingly inexhaustible well of power there is an equally remarkable flexibility and ease of control.

The Straight-Eight has been three years in development and is based on Packard's 24 years of experience.

Whether or not you have previously been conscious of Packard's leadership in design, you cannot sense the great advance which has been made in motor cars until you have ridden in the Packard Straight-Eight.

PACKARD STRAIGHT-EIGHT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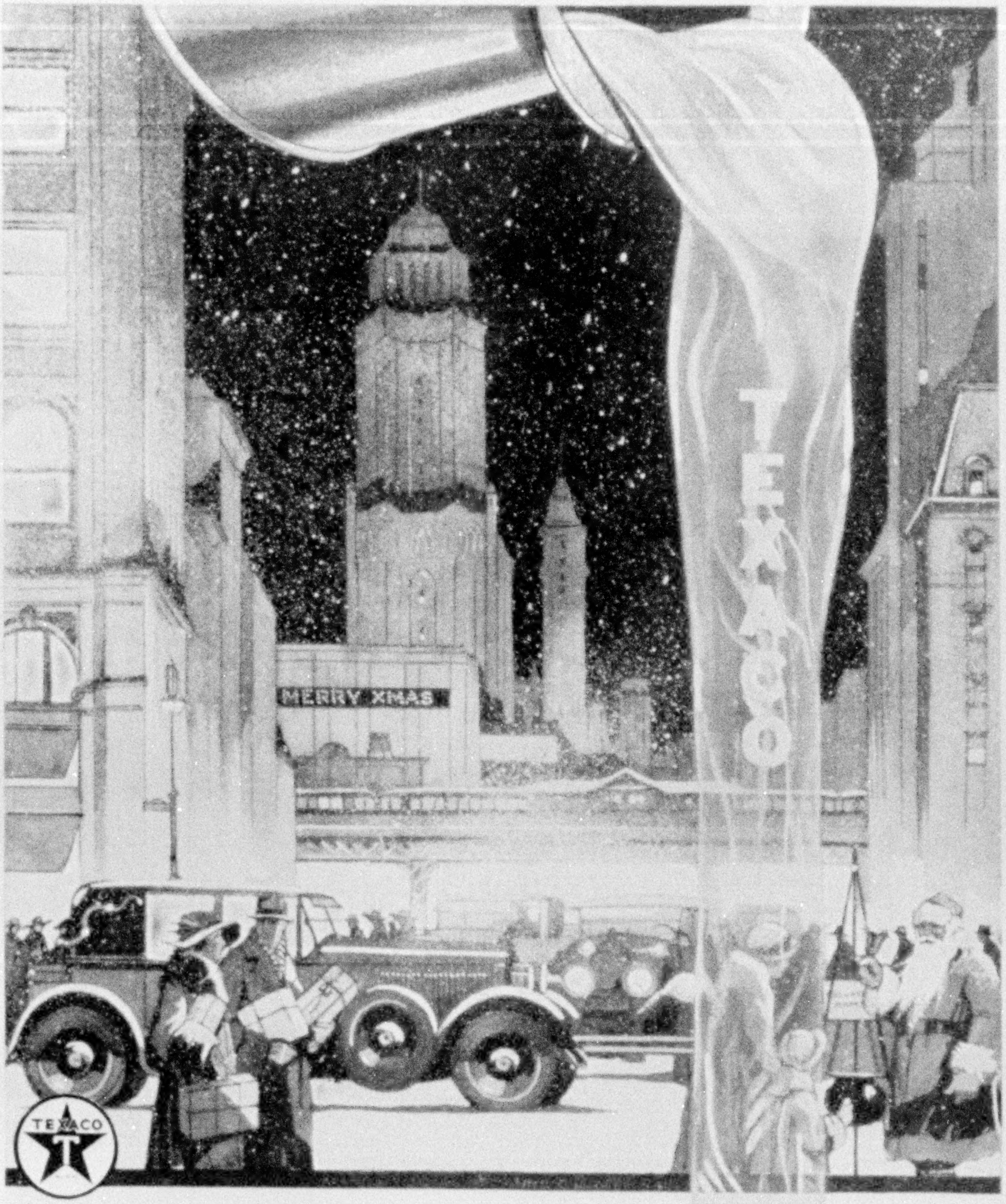
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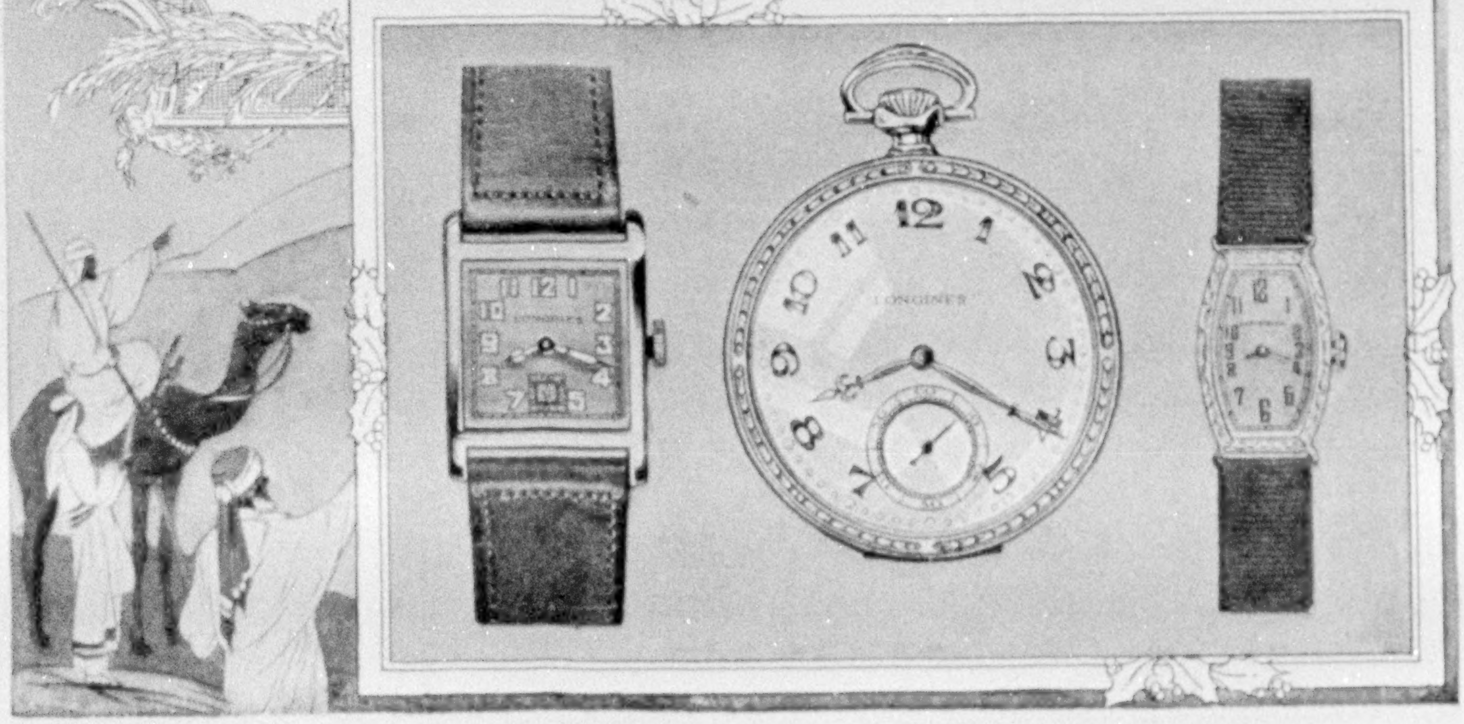

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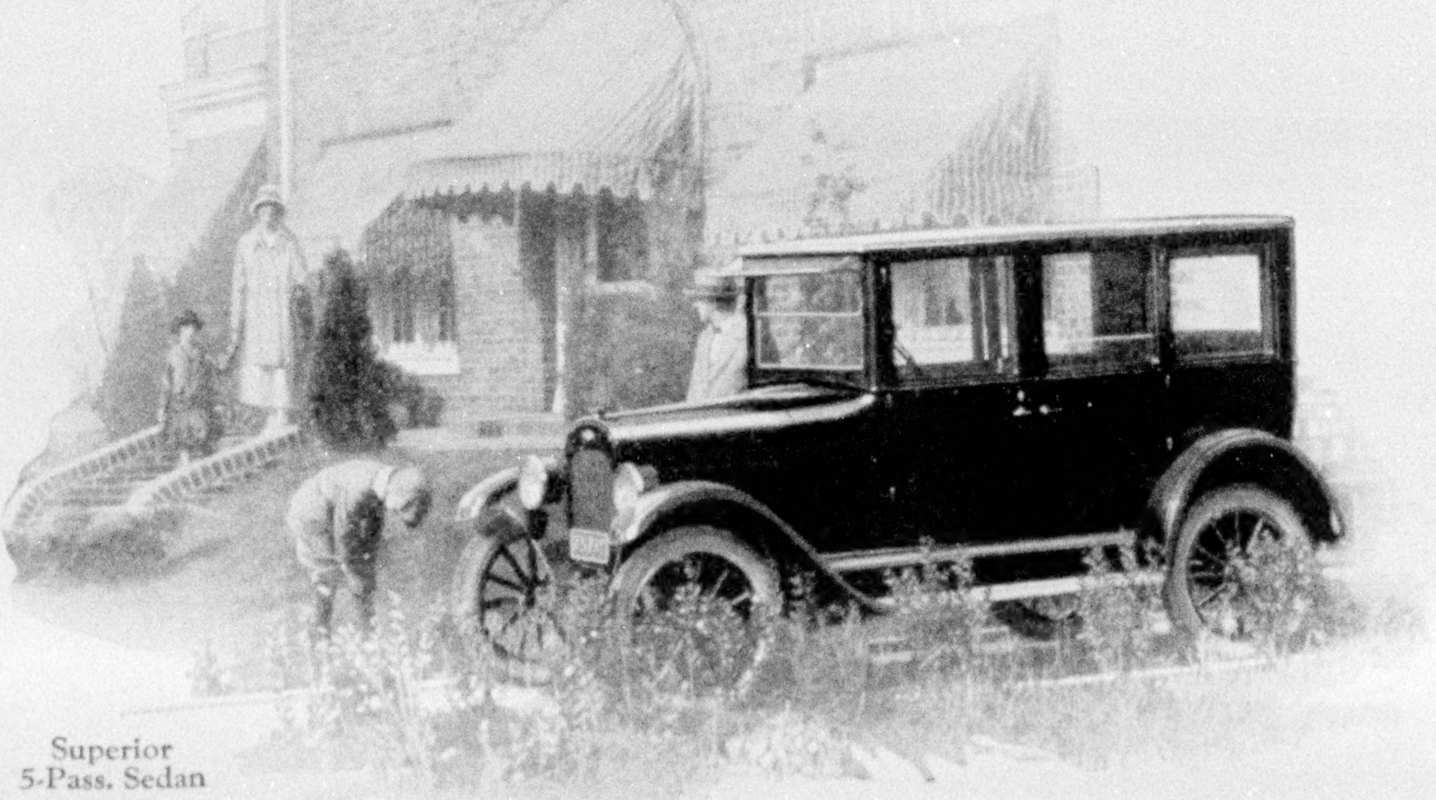

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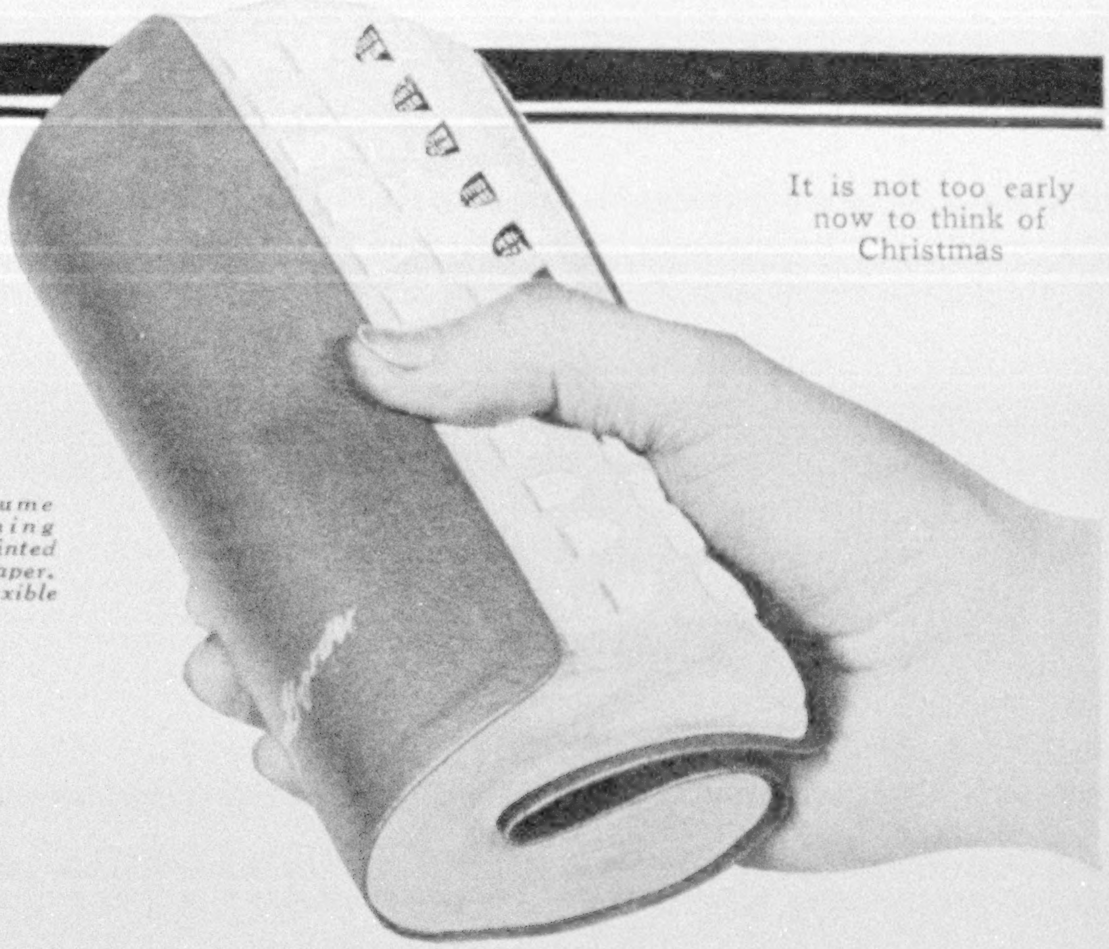

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Four Out of Five Wait Too Long

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Tender, bleeding gums herald Pyorrhea's coming.

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Public dental records show that four persons out of every five past forty, and thousands younger, wait too long. Don't be one of this sorry, neglectful majority.

Pyorrhea, when it strikes, is a merciless foe. The gums recede. The teeth loosen or must be extracted. Germs gather and infection often sweeps through the system.

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On the road to Mandalay
Where the flyin'-fishes play
An' the dawn comes up like thunder
outer China 'crost the Bay!

—*Mandalay*

Though I've belted you and flayed you,
By the livin' Gawd that made you,
You're a better man than I am,
Gunga Din!

—*Gunga Din*

So 'ere's *to* you, Fuzzy Wuzzy, at your 'ome
the Soudan;
You're a pore benighted 'eathen but a first-class
fightin' man . . .

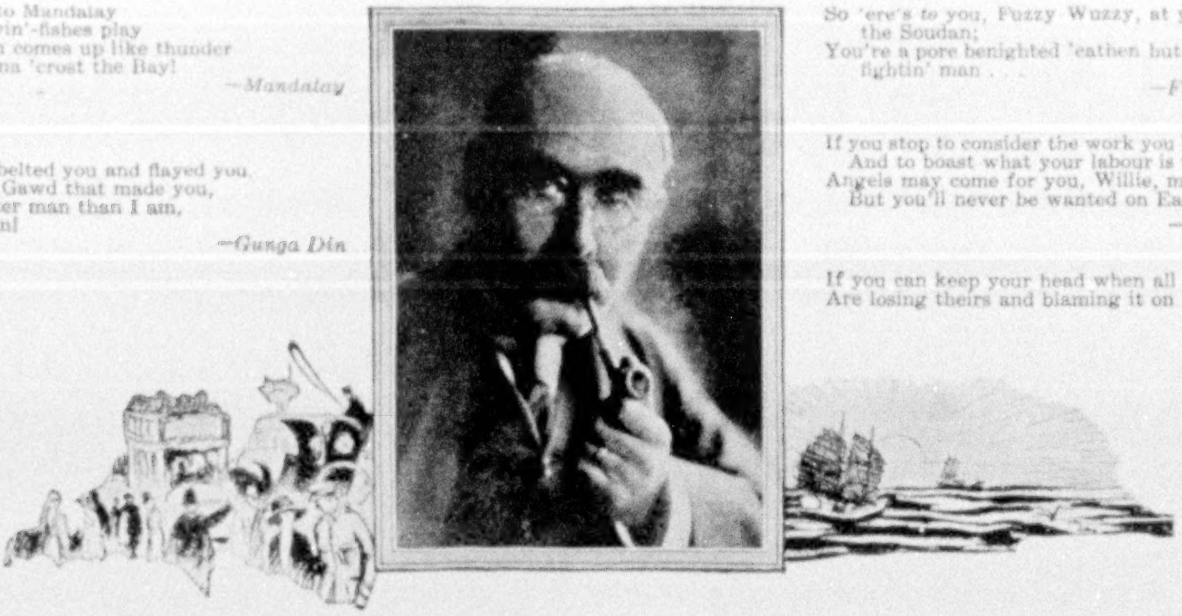
—*Fuzzy Wuzzy*

If you stop to consider the work you have done
And to boast what your labour is worth, dear,
Angels may come for you, Willie, my son,
But you'll never be wanted on Earth, dear!

—*Mary's Son*

If you can keep your head when all about you
Are losing theirs and blaming it on you. . . .

If



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We thrill to campaign life in India and the Soudan with Tommy Atkins in the famous Barrack Room Ballads. Or again, Kipling takes us down to the sea in ships. We are on the *Mary Gloster* with the tragedy of its master's struggle for fortune; or on the perilous *Bolivar* "trailing like a wounded duck, working out her soul; clanging like a smithy-shop after every roll."

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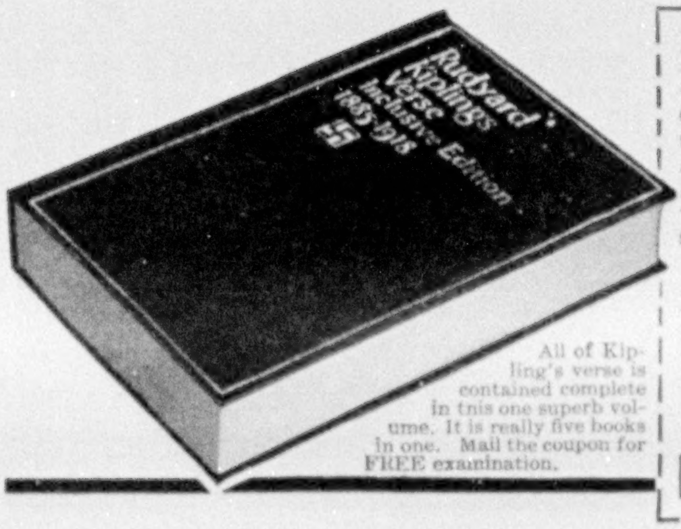

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THE MATERIAL OF A THOUSAND USES

California

Be in the Golden State with us, next Christmas!

A host of new families are enjoying Christmas in the Golden State! Many thousands more than last year. A year ago, many of them battled storms and blizzards.

This Christmas, they celebrate in rose-clad little homes, or verdure-bounded mansions. Last year, their kiddies stayed indoors. This Christmas, they romp in thick, green grass and breathe clean air from sea or mountains.

Californians Are Prosperous

However, Californians do *not* live on climate. But climate makes myriad opportunities from which livings are made. Climate here means tip-top spirits, better health, and maximum production. Climate has brought population, and population multiplies opportunities. California nurtures success, just as it nurtures vegetation.

Californians will start the New Year with at least 75 per cent more per capita bank deposits than other people. They'll start the New Year with per capita savings double the average of the Nation's per capita. There is on the average an automobile to every family in California, even to every farm.

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Schools Are Unexcelled

Youthful California shares honors of leadership in school efficiency with age-old Massachusetts. Here children have unexcelled educational advantages. California takes her rural children to modern schools in great motor buses. California cities keep educational facilities ahead of population. Typically—San Francisco recently voted a $12,000,000 bond issue, this sum to be spent on elementary, junior high, and high schools.

There are seventeen junior colleges in the state, where the first two years of college work may be taken. California's universities attract students from all over the world. Next to the largest of ALL universities is California's own.

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You'll avoid extremes of climate in California. For instance, in San Francisco the summer average temperature is 59 degrees, the winter average 51 degrees, and the annual average 55 degrees—never enervating humidity.

Make your own investigation. You CAN succeed in California if you can succeed elsewhere. Work now for your California future. This time next year, be on a glass-like California highway, breathing fragrant air, seeing inspiring scenery of a legion kinds.

Come to San Francisco

California will welcome tens of thousands of new citizens in 1924. Ambitious people they will be, intent on better futures than they face elsewhere. Be among them! Succeed with them! When Christmas comes again, be established in the great new Empire by the Western Sea. Your future cast with ours. This year, prepare a reasonable stake to see you started, and settle down forever in the Golden State.

Come to San Francisco, the headquarters of Californians Inc., a non-profit organization of citizens and institutions interested in sound development of the state. Some of the most beautiful suburban districts in California adjoin this great port, the metropolis and trading center of the Great Valley and of the many garden valleys of the Coast Range.

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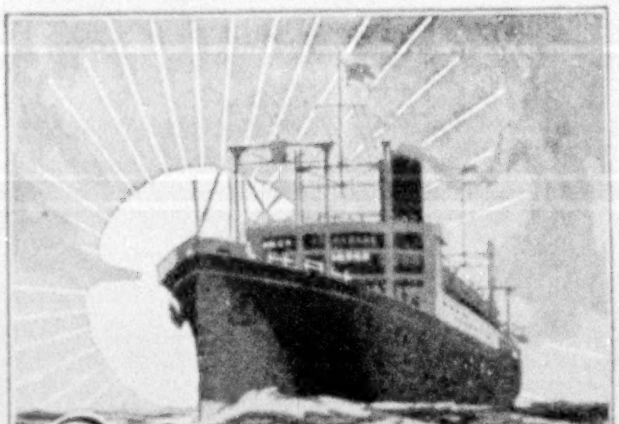

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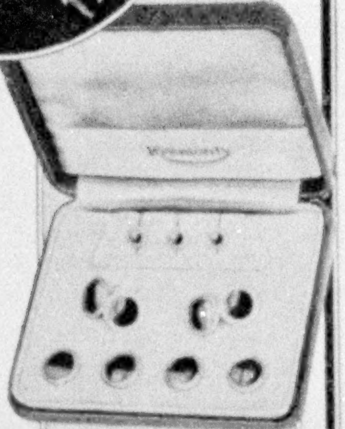

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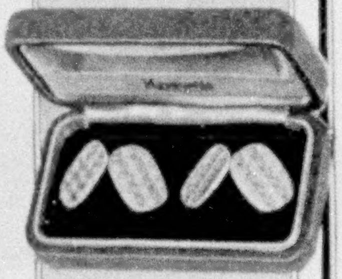

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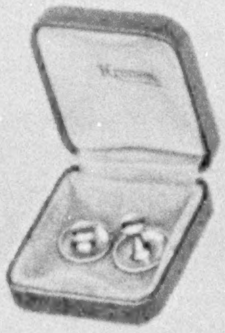

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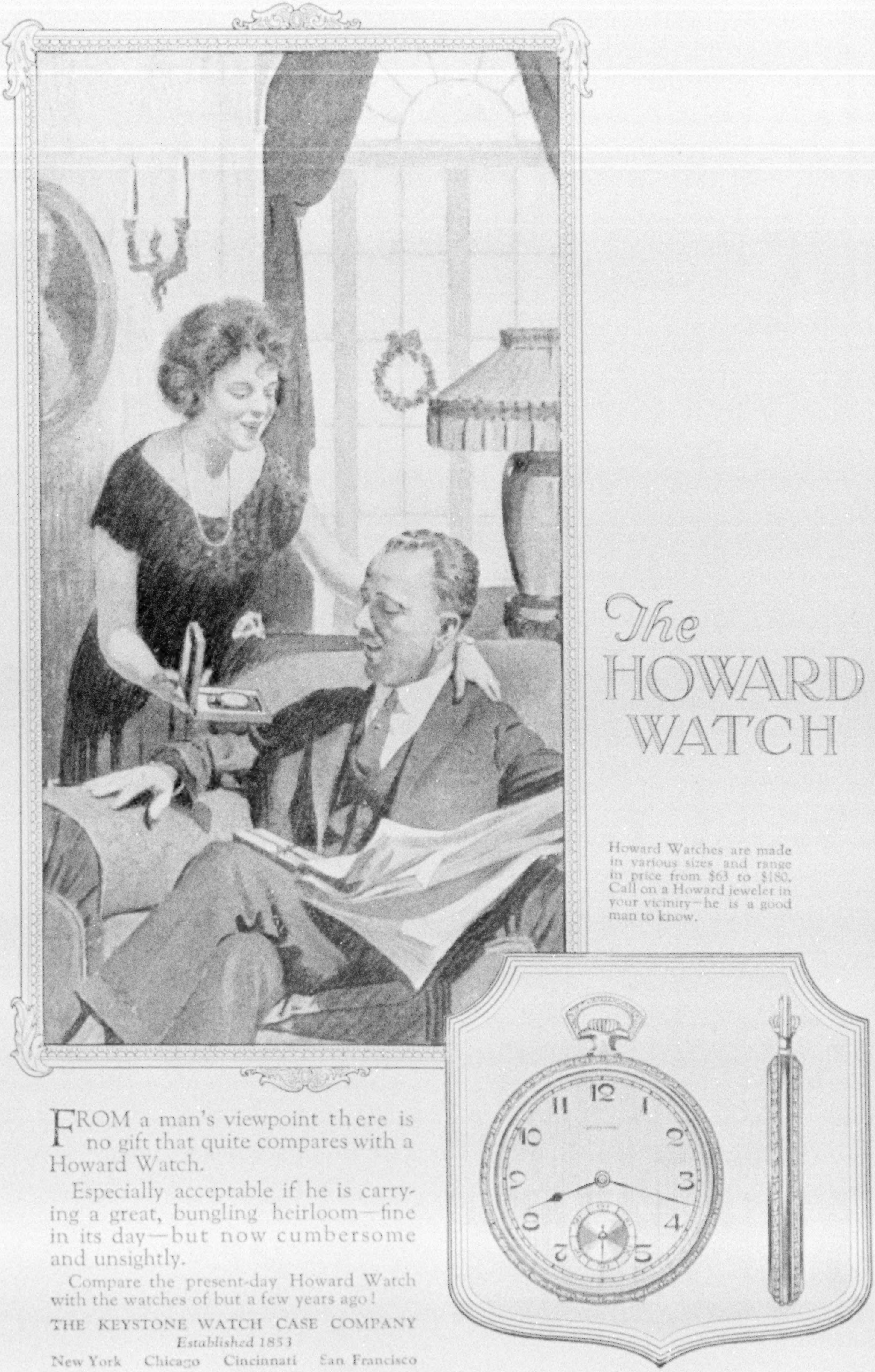

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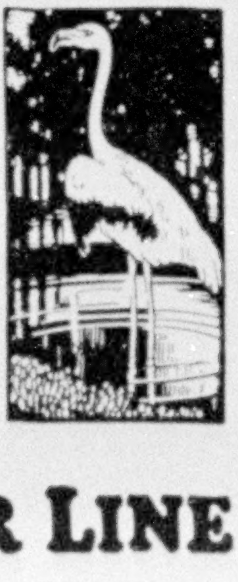

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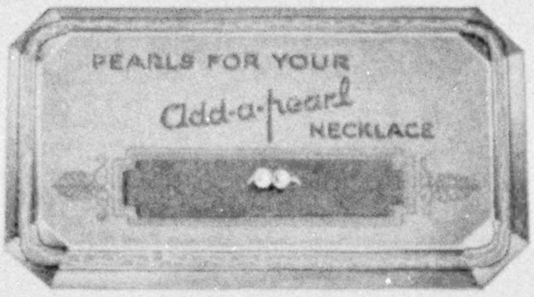

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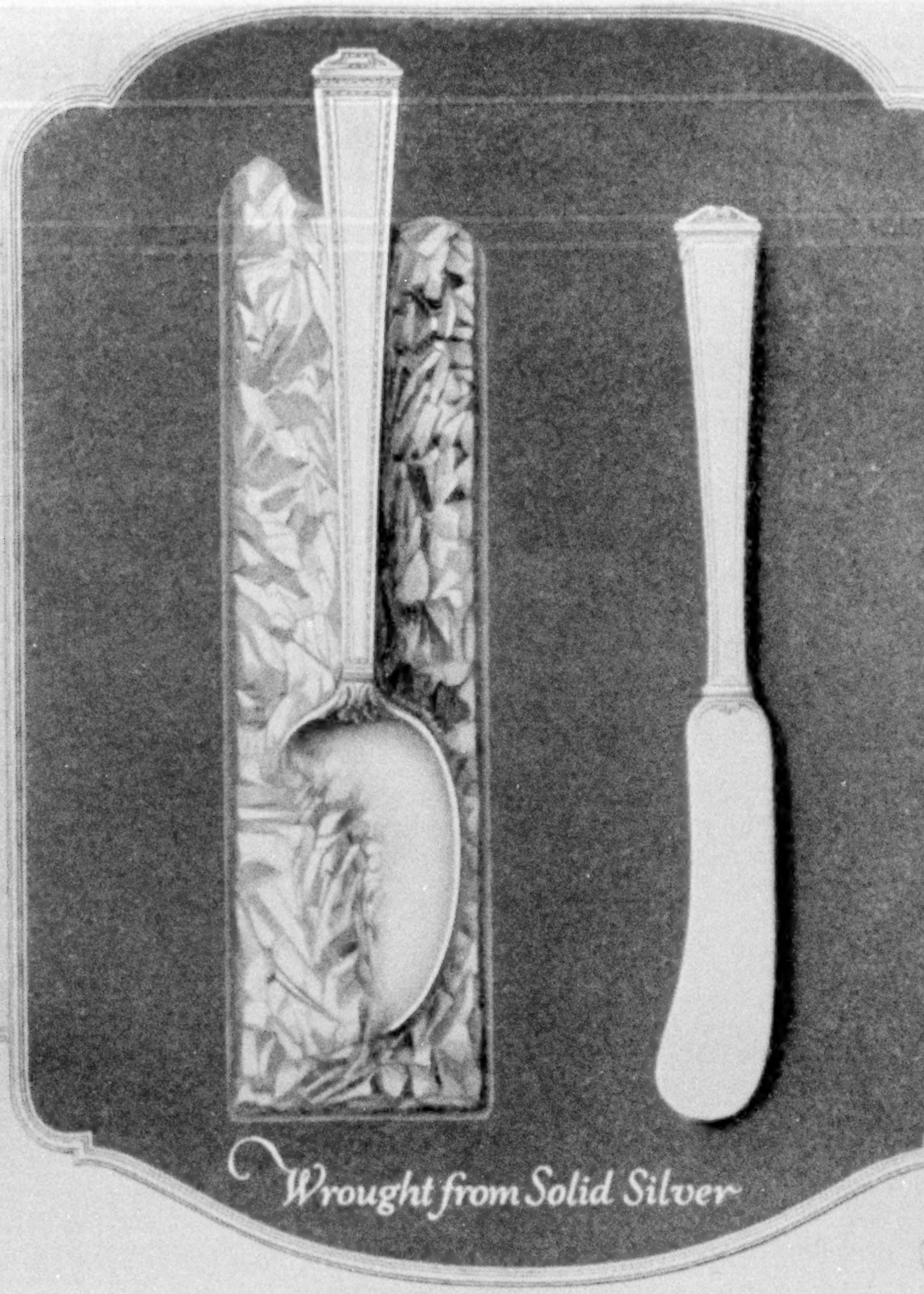

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TRY THIS TEST NOW

Correct answers shown in panel below

1. WOULD YOU WRITE—

Between you and I	or	Between you and **me**
I **did** it already	or	I **have done** it already
Who shall I call	or	**Whom** shall I call
It's just **as I** said	or	It's just **like** I said
The river has **overflowed** its banks	or	The river has **overflown** its banks
I **would** like to go	or	I **should** like to go
I **laid** down to rest	or	I **lay** down to rest
Divide it **among** the three	or	Divide it **between** the three
The wind blows **cold**	or	The wind blows **coldly**
You will **find only** one	or	You will **only find** one

2. HOW DO YOU SAY—

evening	**ev**-en-ing	or	**eve**-ning
ascertain	as-cer-**tain**	or	as-**cer**-tain
hospitable	**hos**-pi-ta-ble	or	hos-**pit**-able
abdomen	**ab**-do-men	or	ab-**do**-men
mayoralty	**may**-or-al-ty	or	may-**or**-al-ty
amenable	a-**me**-na-ble	or	a-**men**-able
acclimate	**ac**-cli-mate	or	ac-**cli**-mate
profound	**pro**-found	or	pro-**found**
beneficiary	ben-e-fi-**shee**-ary	or	ben-e-**fish**-ary
culinary	**cul**-i-na-ry	or	**cu**-li-na-ry

3. DO YOU SPELL IT

supere**e**de	or	super**s**ede	rep**e**tition	or	rep**i**tition
rec**ei**ve	or	rec**ie**ve	sep**a**rate	or	sep**e**rate
repr**ei**ve	or	repr**ie**ve	aco**m**modate	or	acco**mm**odate
donk**eys**	or	donk**ies**	traffi**c**ing	or	traffi**ck**ing
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Answers

1

Between you and me
I have done it already
Whom shall I call
It's just as I said
The river has overflowed its banks
I should like to go
I lay down to rest
Divide it among the three
The wind blows cold
You will find only one

2

eve-ning
as-cer-**tain**
hos-pi-ta-ble
ab-**do**-men
may-or-al-ty
a-**me**-na-ble
ac-**cli**-mate
pro-**found**
ben-e-**fish**-ary
cu-li-na-ry

3

supersede
receive
reprieve
donkeys
factories
repetition
separate
accommodate
trafficking
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He wrote from Buenos Aires

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MR. WHITE writes us on poor paper. He says it makes him feel ashamed. His letter follows:

> GENTLEMEN:
>
> Size up the men who use Old Hampshire Bond, not only in their business, but also for their private correspondence. Do these men shave every morning to impress others, or for that fresh feeling of cleanliness that shaving produces?
>
> The well-groomed man, if he is able to put it into words at all, will say that there is a subtle, indefinable personal satisfaction attaching to fresh linen, well-fitting clothes, and a freshly shaven face, and that he clings to these things simply because he wouldn't be comfortable without them. Then he'll also tell you that this same subtle, indefinable satisfaction attaches to Old Hampshire Bond, and that's, after all, the only reason he clings to it. He has a favorite razor and a favorite style of collar, and Old Hampshire Bond is his favorite paper for much the same reason.
>
> I know, because in the United States I used Old Hampshire and every time I write a letter on paper such as this is written on, I have much the same feeling that I've had when I had to put on yesterday's collar. So please let me know if Old Hampshire Bond is on sale in Buenos Aires and if so, where?
>
> Yours very truly,
>
> JOHN W. WHITE
> Calle B. Mitre, 367, Buenos Aires, Argentina.

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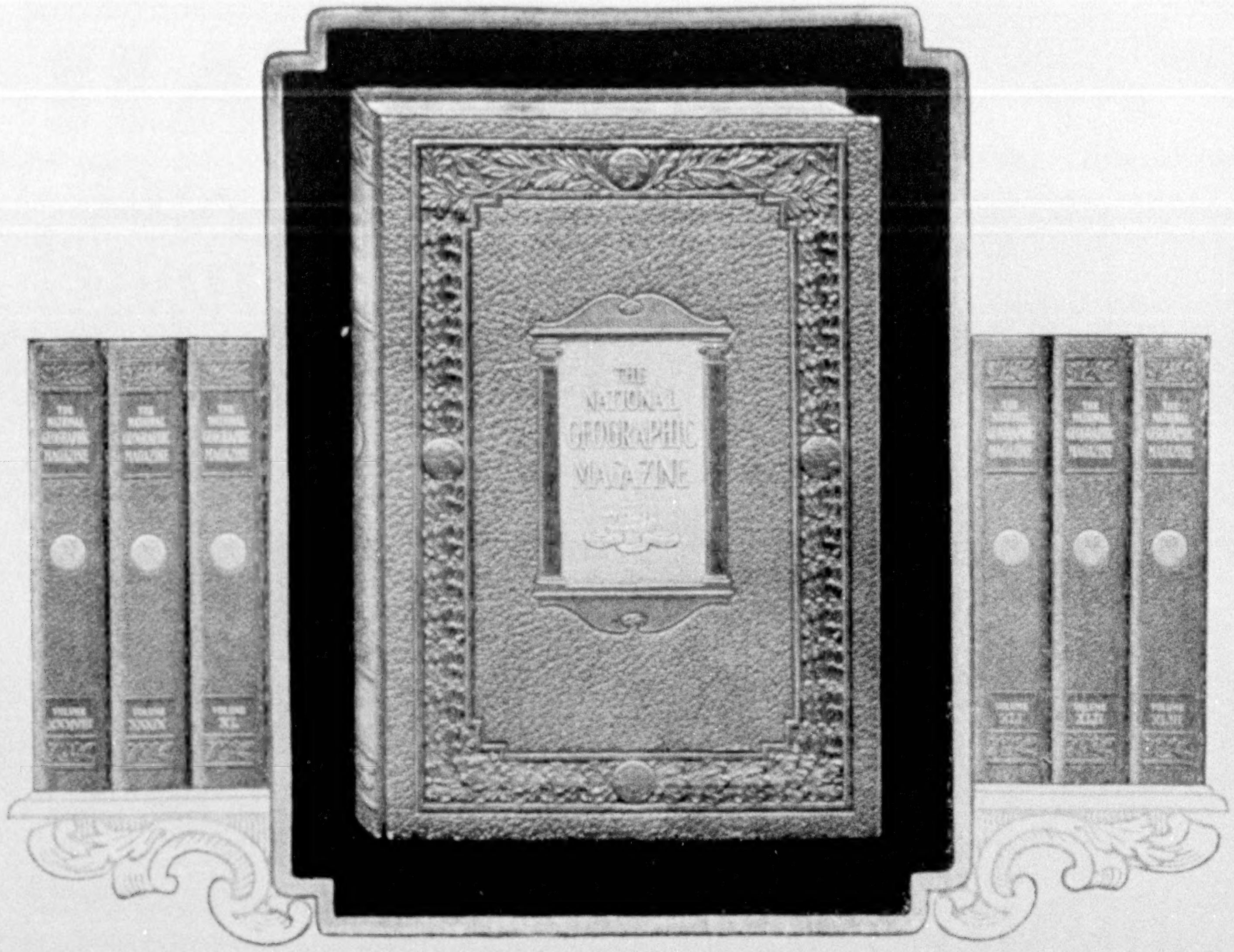

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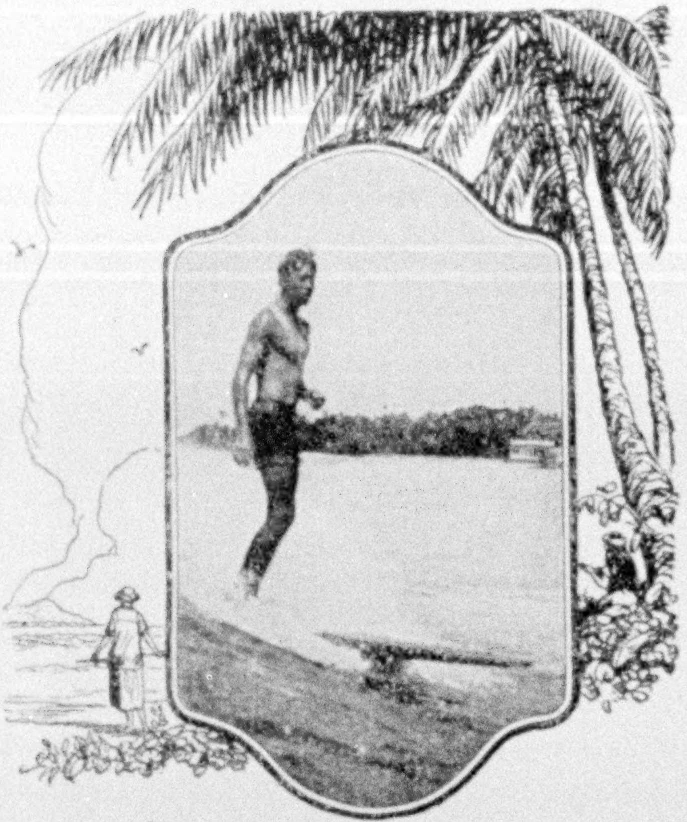

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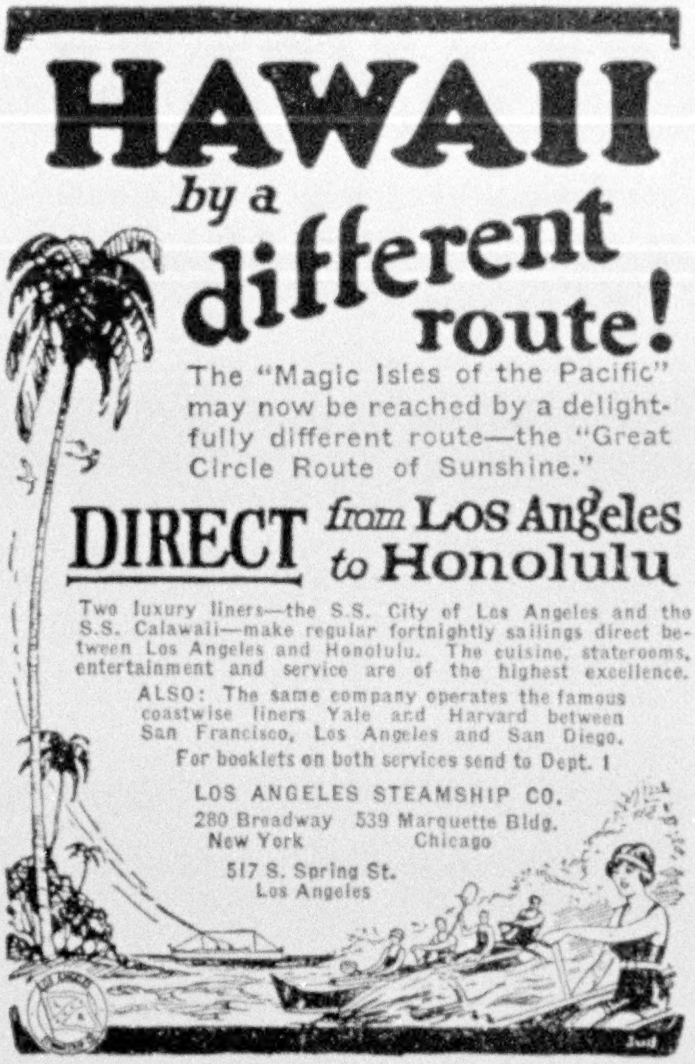

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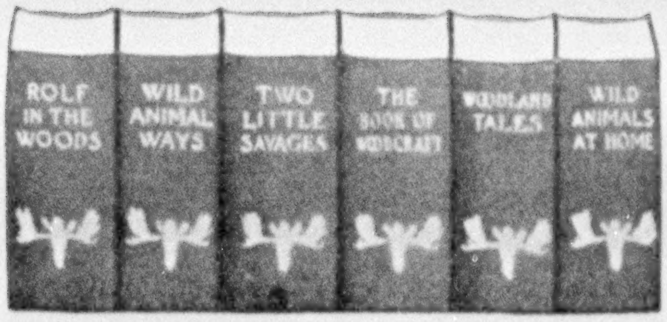

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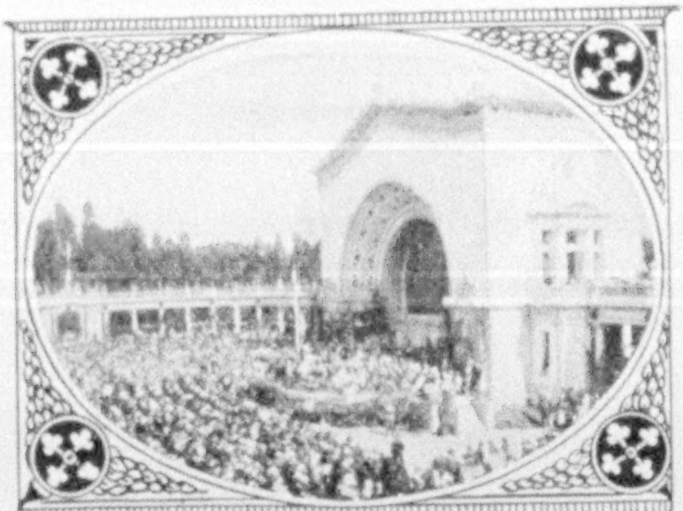

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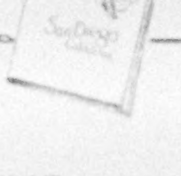

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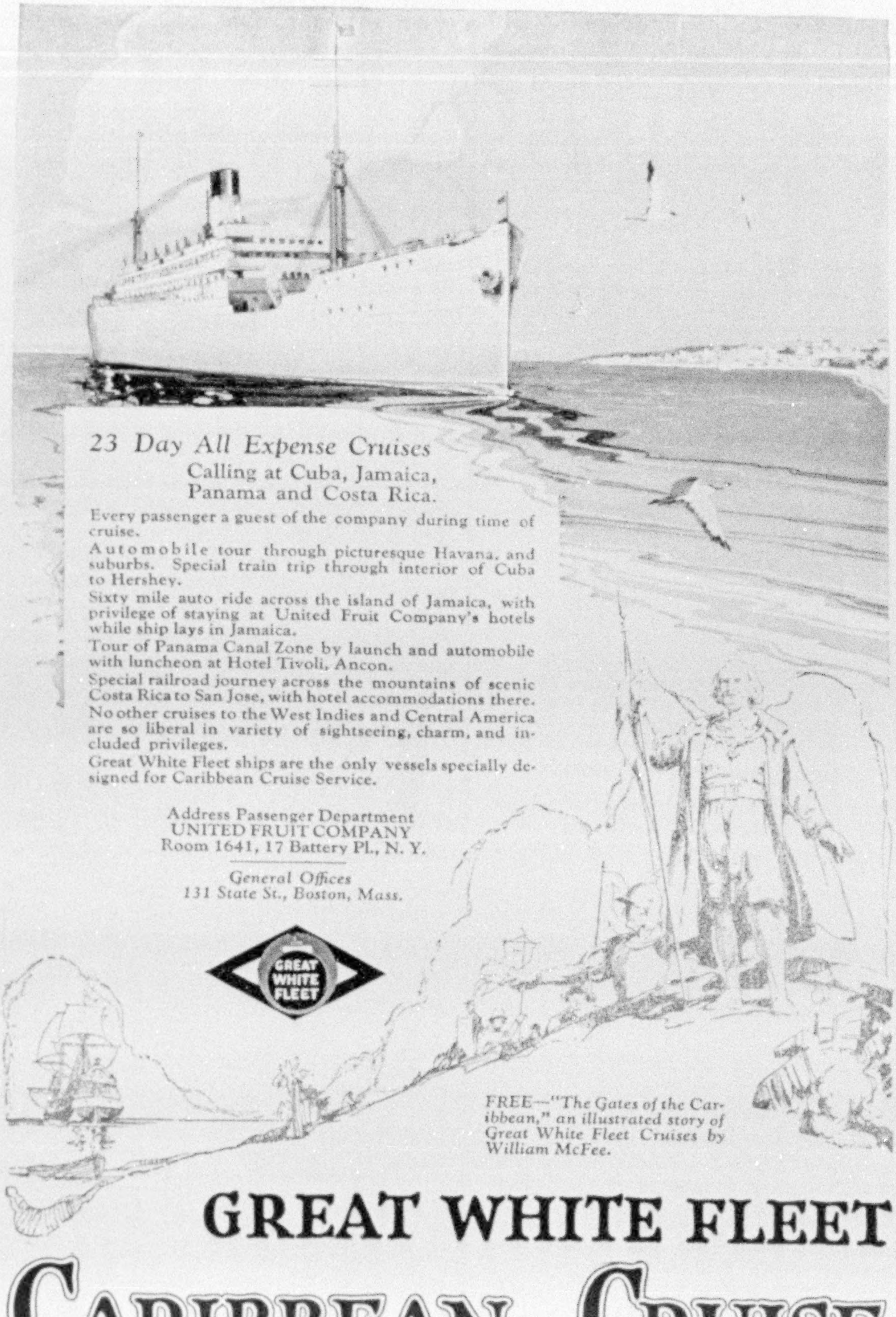

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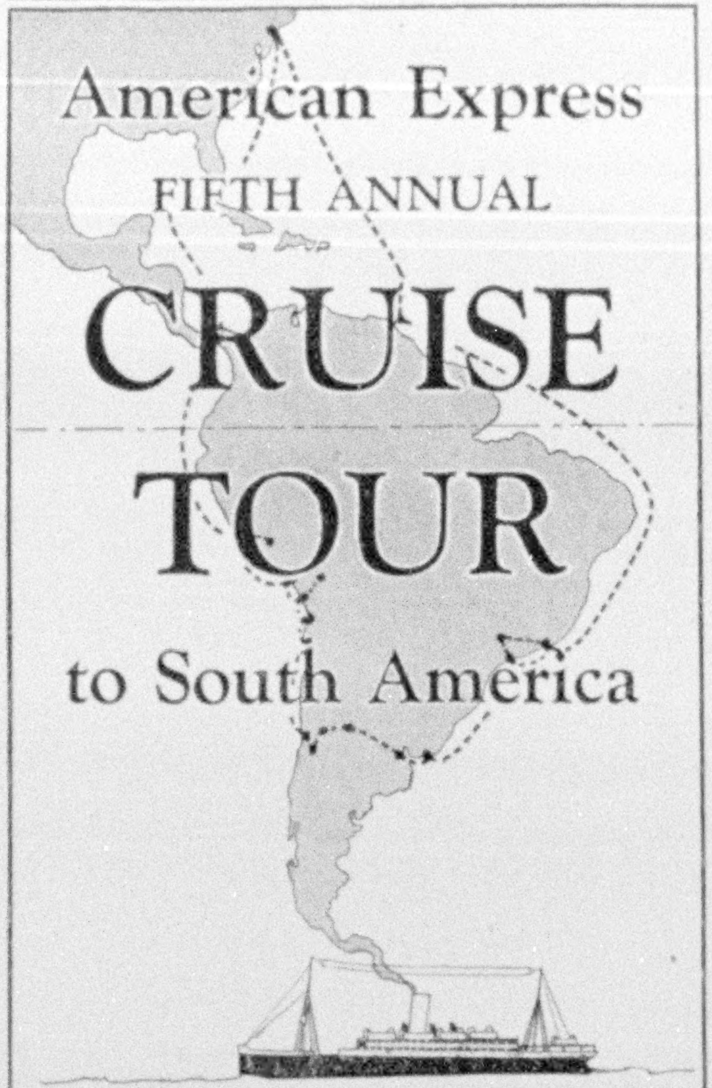

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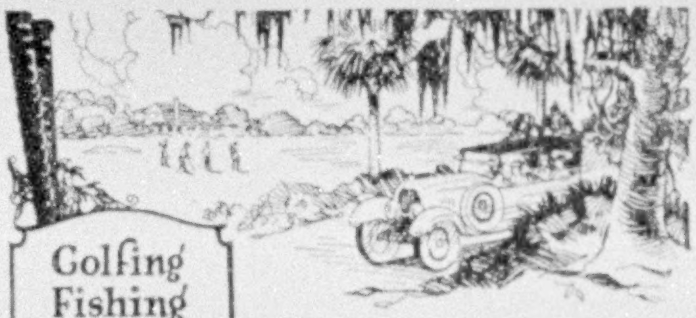

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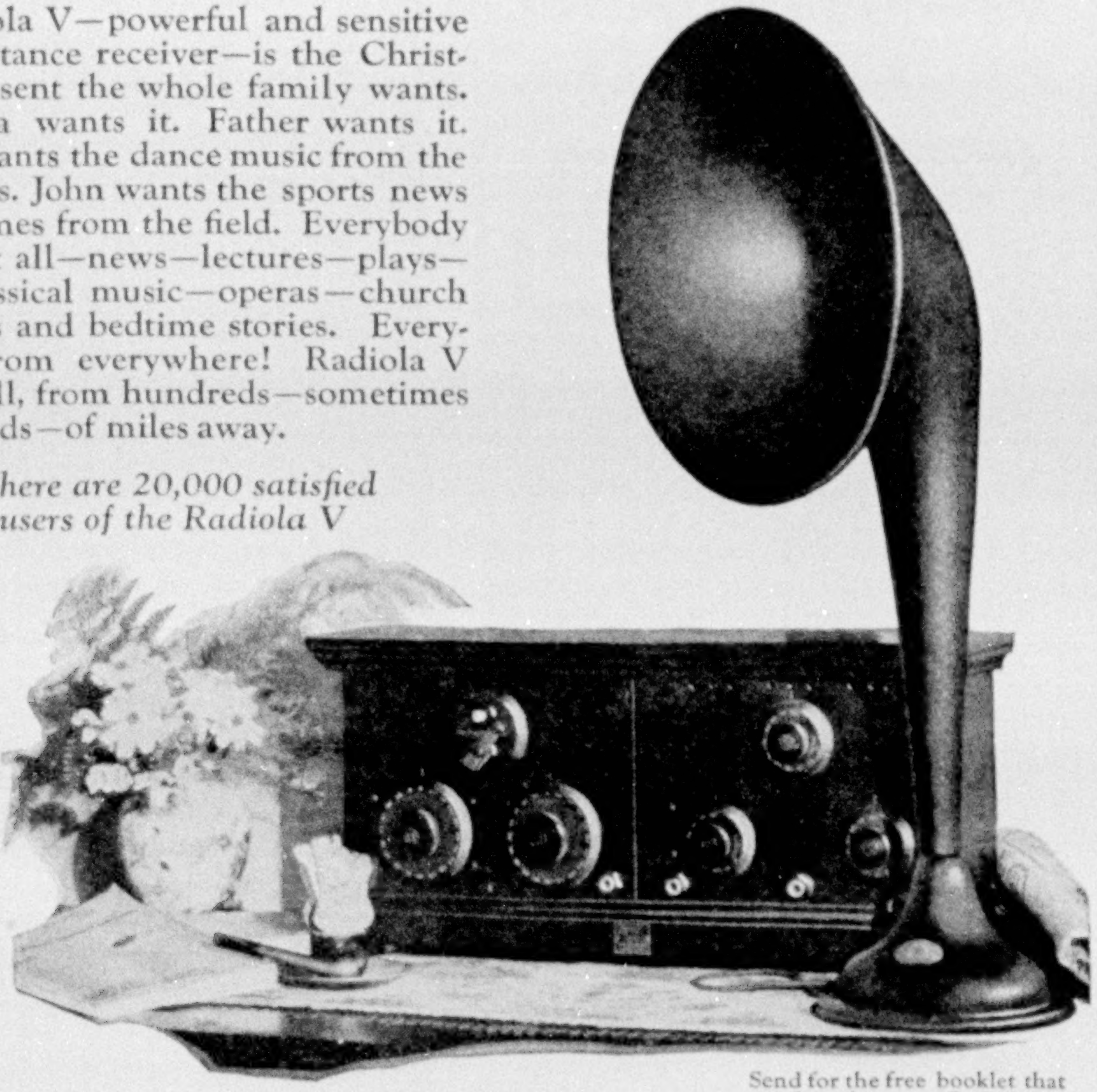

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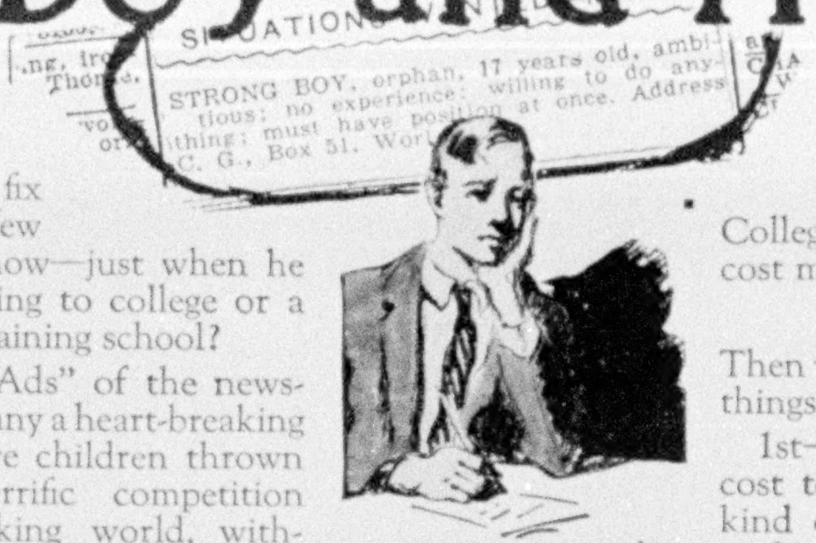

SITUATIONS WANTED—MALE.

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WILL your boy be in a fix like this a few years from now—just when he should be going to college or a vocational training school?

The "Want Ads" of the newspapers tell many a heart-breaking story of mere children thrown into the terrific competition of the working world, without training, without equipment.

Look through the "Help Wanted" columns in the newspapers and read advertisement after advertisement beginning "Expert", "Competent", "Educated", and then ending up with either "big pay" or "high salary for the right man".

* * * *

You do not want your child to take a back seat in life. You do want him to be a leader in his chosen line.

Just about *one* family in *three* can afford to enter their boy in high school and only *one* family in *fifty* can see him clear through college.

Now what are you doing to make it possible for your boys *and girls* to get a good education? How are you going to have the money ready when you must have it—in 15 or 10 years, or sooner? Colleges and all kinds of schools cost money.

* * * *

Then why not do these essential things and do them now?

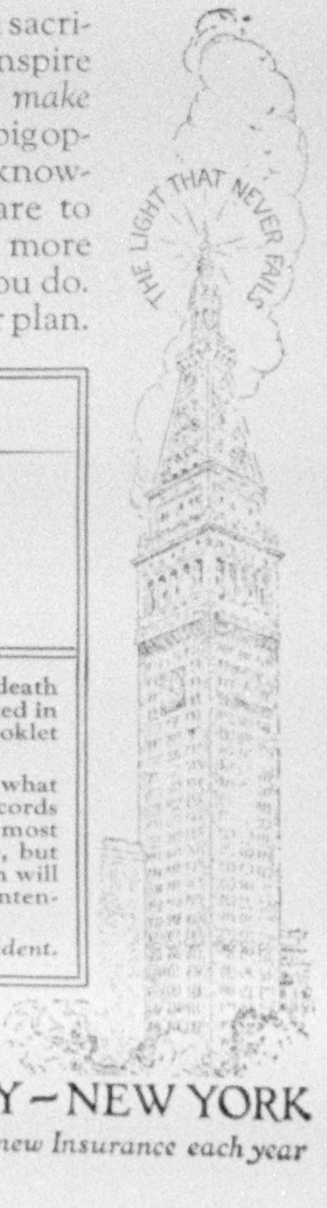
1st—Find how much it will cost to give your children the kind of higher education you want them to have.

2nd—If you have the money now, put it aside.

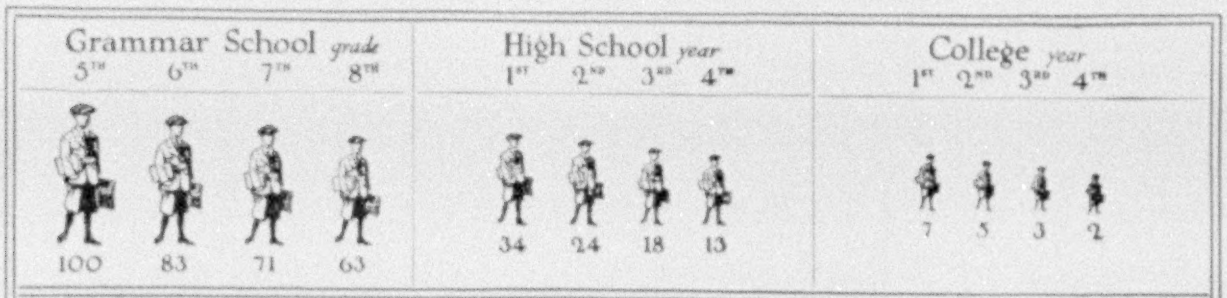
3rd—If you haven't the money, figure out a way of saving for your Education Fund.

4th—Begin now—this week—to lay aside the first small installment.

The mere fact that his father and mother are making a sacrifice for him, is likely to inspire any red-blooded boy to *make good* and get ready for his big opportunity. The pride of knowing that your children are to have their chance will more than pay you for what you do. Plan now—carry out your plan.



THE LIGHT THAT NEVER FAILS



Here is the significant story of the children who enter the 5th grade of the public schools of the United States. Only 63 of each 100 graduate from grammar school—13 from high school—and 2 from college, according to Bulletin No. 34 of the U. S. Bureau of Education.

By giving your children the kind of training they need, you will make them happier, more successful men and women, and your country will be the richer for your contribution of better citizens.

The Metropolitan Life Insurance Company will arrange, if you like, to supply your boy (or girl) with funds needed, in case of your untimely death—or if you live, for that matter. If interested in this phase of the question, write for booklet describing our Educational Fund policy.

But in any event begin now to prepare for what you must do *in case you live.* Statistical records prove that of the parents who read this page most of them will live for fifteen years or more, but failing to make early and proper preparation will be unable to carry out their present good intentions as to educating their children.

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Vol. XLIV, No. 6 WASHINGTON December, 1923

THE NATIONAL GEOGRAPHIC MAGAZINE

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FISHES AND FISHERIES OF OUR NORTH ATLANTIC SEABOARD

By John Oliver La Gorce

Author of "A Battle-Ground of Nature," "Pennsylvania, the Industrial Titan of America," "Devil-Fishing in the Gulf Stream," "Treasure-House of the Gulf Stream," "The Fight at the Timber-Line," etc., in the National Geographic Magazine

THE story of the fishes and fisheries of the North Atlantic seaboard of the United States is one that has the fascination of a romance.

Whether we consider the biology of the species which are the prizes of the fishing fleets, the methods of reaping this harvest of the seas, or the stern battle against the depletion of the supply, there are stirring chapters at every turn.

The world annually levies a tribute upon the seven seas of half a billion dollars' worth of fish, of which Europe collects approximately half, the United States nearly a third, and the remainder of mankind the other sixth.

In terms of weight, the portion collected by the United States amounts to 2,600,000,000 pounds, including shellfish. Three-fourths of this annual harvest reaches the markets in fresh condition; the remainder goes to the consumer as canned, salted, and smoked fish.

The North Atlantic fisheries of the American seaboard reach from the Newfoundland Banks to the Delaware River, and represent the major sea fisheries of the Atlantic coast, producing some seven hundred million pounds of sea food annually.

Considering the fisheries of the United States in these waters, one finds upward of fifty different kinds of fish and shellfish called for by fish-eating citizens, helping to swell the total annual catch. Eighteen kinds have more than two million pounds each to their credit in the national larder.

MIGRATING EYES

Biologically, perhaps the most interesting of all the species that figure in the returns are the Flatfish—Flounders and Halibuts—with their changing forms and migrating eyes. By what strange quirk of Nature the left eyes of species inhabiting cold water usually migrate to the right side of their heads, while the right eyes of most species inhabiting warm water journey over to the left, no scientist will venture a guess (see Color Plate II).

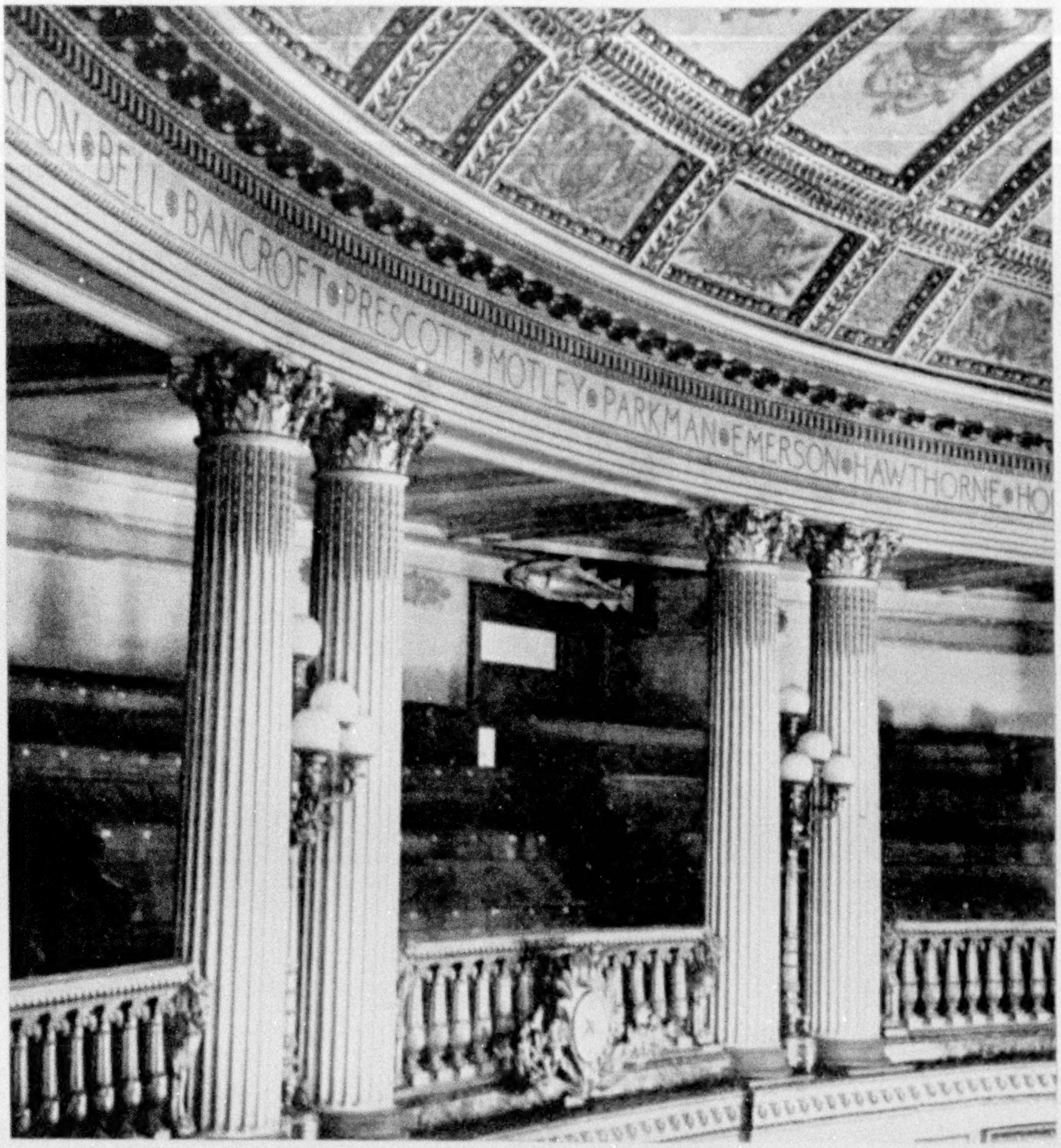
When they are hatched, all Flatfish are of orthodox symmetrical shape, with conventionally placed mouths and eyes.

After they swim around in ordinary fashion for a little while, the members of the Flatfish family exhibit a tendency to turn to the one side or the other. Immediately after this peculiar desire begins to develop, the eye on the lower side seems to acquire a wanderlust. Stephen R. Williams, who studied this change, says that the optic nerves are placed in the youngling to provide for the migration.

The first sign of the transformation is a rapid change in the cartilage bar lying in the path of the eye that is to migrate. Then comes an increase of the distance between the eye and the brain, caused by the growth of facial cartilages. In the

A NOVA SCOTIA FISHERMAN HAULING IN HIS NET

As pressure on the world's food supply of every kind increases, knowledge of the migration, feeding, and breeding habits of fish is essential to the formulation of intelligent fisheries legislation in order to conserve the abundance of the ocean's supply of this palatable and nourishing food.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Photograph by International Newsreel

THE "SACRED CODFISH" IN THE BOSTON STATE HOUSE

In the new Hall of Representatives, in Boston, hangs a wooden Codfish "as a memorial of the importance of the Cod Fishery to the welfare of this Commonwealth," in accordance with a resolution passed in 1784. It may be seen above the transom of the door. Next to the Herring, the Cod is the world's most important economic fish, and the Cod fisheries of the Newfoundland Banks are the oldest in North America. Georges Bank, southeast of Gloucester, also is a favorite fishing ground.

Winter Flounder, three-fourths of the 120-degree migration takes place in three days. What if that should become a human habit!

THE ORIGIN OF FLATFISH

The extent of the eye migration and of the flatness of the species is closely related to its habits. The Sole and the shore Flounder, which keep close to the bottom, are more twisted than the Halibut, the Sand Dab, and the Summer Flounder, which are more given to free swimming.

How this deviation from the conventional bilateral shape arose is a mystery. Whether there came a "sport" in the family tree at some stage of its history, or whether the deviation grew from a gradual modification of the adults under

Photograph by H. Armstrong Roberts

HAULING NETS DOWN TO THE SEA

Though America's total fish crop, according to recent figures, amounts to 2,600,000,000 pounds, we probably eat less fish than any other country of the world—only 24 pounds a year per capita as against 60 to 70 pounds in Europe. The United States Bureau of Fisheries has performed valuable service not only in inducing the public to eat more fish, but also in popularizing new varieties.

the influence of their environment, cannot be said. If it came from the latter, selection naturally favored its appearance earlier and earlier in the development of the fish, until it reached the larval stage. Earlier transformation would be disadvantageous, since there is a lack of plankton — that imperative, if almost microscopic, food supply of the newly hatched— at the sea bottom, and the transformed fishlings would find a scarcity of provender at a critical period in their lives.

It has been noted that many transformations do occur even in the egg; but the precocious youngsters thus hatched have less chance to survive, and hence are less able to transmit to the future the tendency to earlier change.

THE ANADROMOUS FISHES

Some species that help constitute the fisheries of the North Atlantic are anadromous—that is, they spend most of their lives in the sea, but come into fresh water to spawn. Among these are the Salmon, the Shad, the Alewife, the Sturgeon, and the Striped Bass. On the Pacific coast the most striking instance of this is the Chinook Salmon, which ascends the Columbia River for a thousand miles, and the Yukon for two thousand, to find its spawning ground.

How acute this instinct has become is shown by a Canadian experiment. Salmon were accustomed to run up the Nicola River to spawn, and at one place they passed an island in midstream. It was noted that they always took one channel around this island and neglected the other. So a dam was built across the channel they were accustomed to use and the other was left open.

At the next run, when the fish approached the barrier across the channel their ancestors had used in passing the island, not a single one of them would take the other channel. They all turned back instead.

Sometimes anadromous fishes, wandering up rivers, get into landlocked lakes. Usually they do not prosper, but die out in their new environment. It often happens, however, that such anadromous fishes as the Branch Herring and the Salmon, getting into waters out of which they are unable to find their way, so change their habits in the course of time that variations from their ancestors set in, which mark the beginnings of the formation of new species.

THE EELS' SPAWNING HABITS

Other fishes of commercial importance in North Atlantic waters have habits of spawning directly opposite to the anadromous species, and they are called catadromous fishes. The true Eel is the most striking example of this class of fish.

Until recently, the location of its spawning ground was an unsolved mystery of the sea. Finally a Danish expedition succeeded in locating it in the region between Bermuda and the Leeward Islands, where the water reaches the depth of a mile.

Although they are so nearly alike that the layman cannot recognize the difference between them, and although their breeding grounds partially overlap, the European and American species neither cross nor visit one another's shores.

The eggs are laid at depths of about 650 feet and the larvæ continue to rise toward the surface as they grow. At this stage, and until they reach their respective shores, they are mere bits of ribbon, so transparent that the vertebræ of their backbones may be counted without difficulty. The only difference yet found between the European and American species is that the European has a few more vertebræ.

EELS AT THE PARTING OF THE WAYS

Both species start out, mayhap together, over a route neither has traveled before. But when they come to the parting of the ways the European Elver, with a three years' journey ahead of it, says good-by to its American cousin, which has only a year's swim to get to its future home. By what means this unerring homing instinct is transferred from the parents, which never return, to the offsprings, that must travel a road they have never been over, is a mystery that will probably long await a solution.

The spawning habits of fishes differ as greatly in other respects as in those just mentioned. Some eggs are laid at the surface and left to their fate, with no responsibilities of any kind for the parents; others are heavy enough to sink to the bottom. Some fishes, like the King

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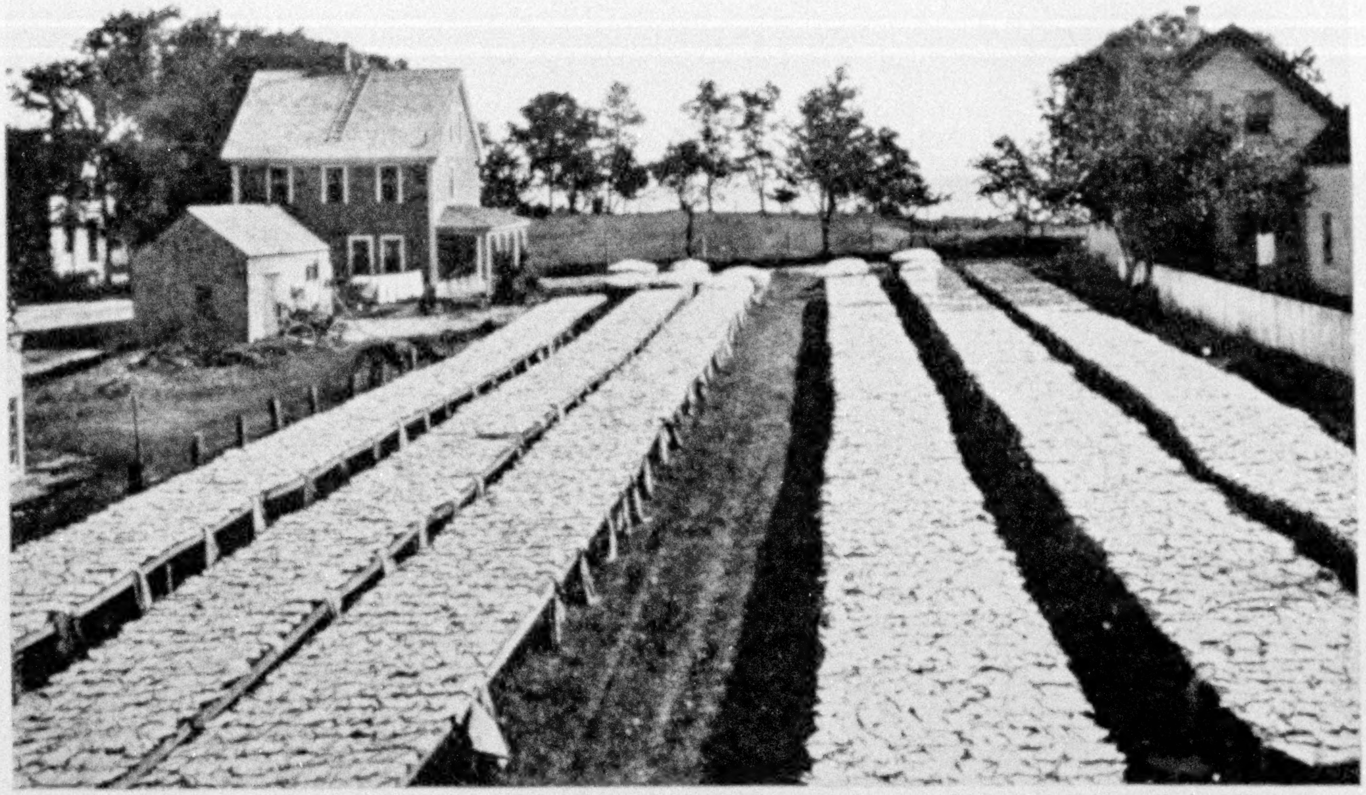


Photograph from Ewing Galloway

DRYING FISH AT DIGBY, NOVA SCOTIA

When fish is dried in the open air, it sometimes must be protected from sunburn by canvas awnings, and from rain at night by coops. Although fish is also dried in some factories in large steam-heated shelf driers, this method tends to be too rapid, so that the fish is dried only on the surface, instead of uniformly throughout.

Salmon, lay their eggs on the stream bed, and the male covers them with gravel, after which male and female drift helplessly down the stream, tail first, and die.

THE LUMPFISH A DEVOTED GUARDIAN

Some species, like the Sticklebacks and the Lumpfish, guard their eggs until they are hatched. The courage and devotion of the male Lumpfish to his task has often been noted. He eats nothing while guarding the eggs, but constantly fans the egg mass to keep it free from silt and bathed in flowing water. He never deserts his post save to drive away some intruder, and finally, when the eggs are hatched, he is a picture of exhaustion and hunger.

The males of other species, including some of the common Catfishes, carry the eggs in their mouths until they hatch. The females of still other species, following the example of the Lobster, glue their eggs to the undersurface of their bodies (see text, page 583). The male Sea Horse opens up a little pocket beneath its body, takes in the eggs from its mate, and carries them in the tiny pouch Nature provided until they hatch. Hundreds of perfectly formed Sea Horses are thus liberated at a hatching, so tiny in size the human eye can hardly distinguish them, yet perfectly formed.

Not all fishes are oviparous. Some are viviparous, such as most Sharks, the Sawfishes, the Rosefishes, the Rockfishes, and the Surf Fishes.

The number of eggs laid varies widely in different species. Scientific census-takers of Uncle Sam report that the Herring lays about 25,000, the Sturgeon about 635,000, the Halibut as many as 3,500,000, while the Cod has been known to lay more than 9,000,000.

SLIM CHANCES OF SURVIVAL

One can gauge the perils through which the various species of fish pass from the egg state to maturity by the number of eggs they spawn. It is demonstrable mathematically that if all the eggs of a single female Herring were to produce similarly productive generations, in ten

CANNING LOBSTER MEAT

The Lobster forms the principal means of livelihood in many New England communities and supports a fishery from Labrador to Delaware. The toothsomeness of the American variety was early recognized, and a regular fishery has existed on the Massachusetts coast for nearly a century. The fishing grounds are being depleted rapidly, the size and number of Lobsters caught are diminishing; hence the center of the fishery has shifted northward, first to Maine and then to the Canadian provinces.

years the oceans would be overflowing with Herring, and all the other creatures of the sea literally would be crowded out of existence.

Indeed, it has been proved that, if only three eggs from each female of each species should develop into adult fish similarly productive, fish life would multiply so rapidly that the seas would soon become vastly overcrowded. What does happen is that less than one egg in two million in the Cod produces a reproducing Cod, and even in the Herring less than one in ten thousand successfully runs the gamut of existence. Hard, indeed, would be the road of life insurance companies of the fish world!

ENEMIES OF FISHES

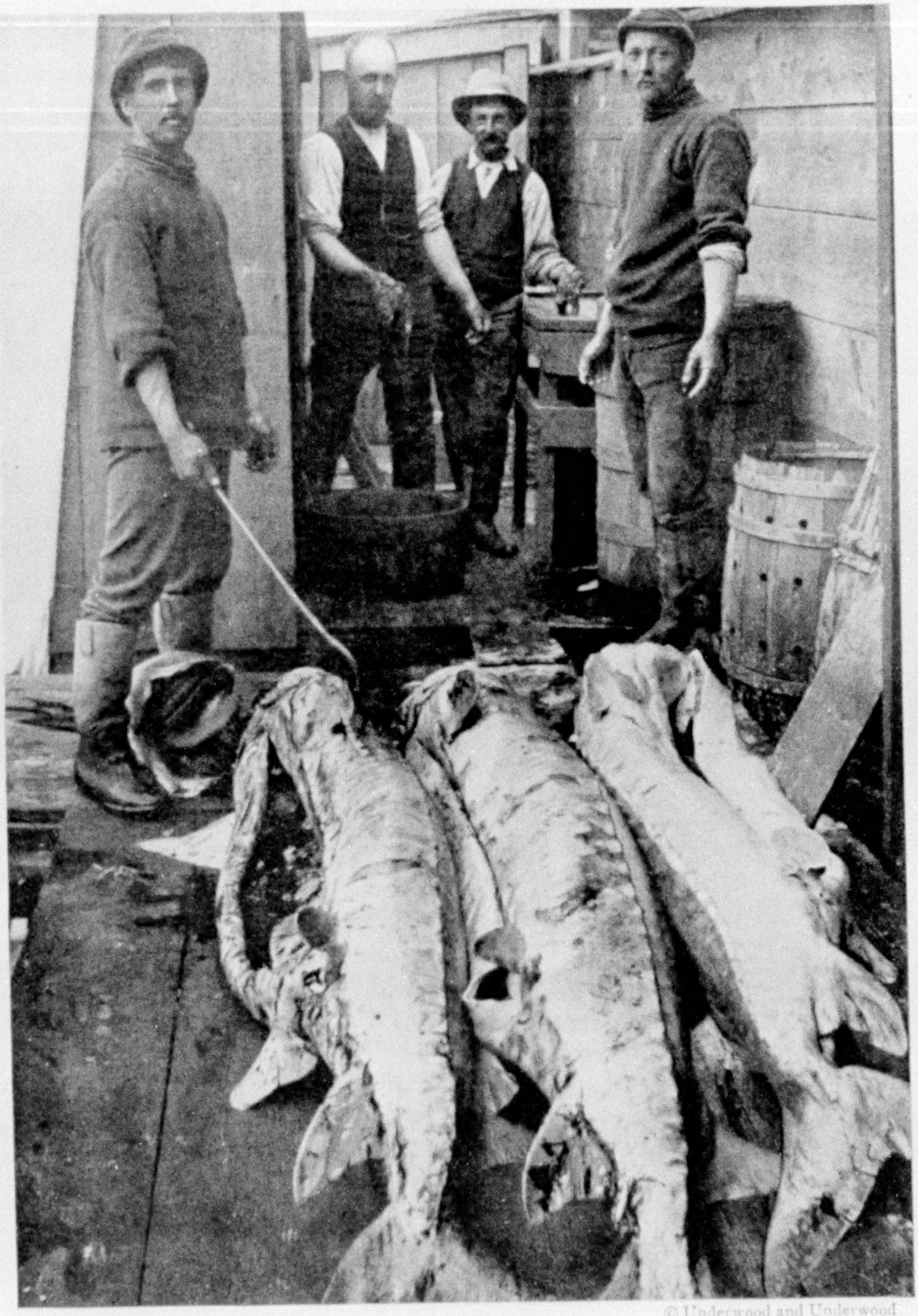
In this connection it is interesting to note that Nature's need for females in many species exceeds the requirement for males. In the case of the Conger Eel, the ratio is nineteen females to every male, and in that of the Herring, three females to every male.

The perils fish have to face are innumerable. Huxley estimates that only 5 per cent of the Herring destroyed annually by all Herring enemies in the world find their fate at the hands of man.

The other 95 per cent are the victims of whales, the porpoise family, seals, and other mammals; Cod, Haddock, Mackerel, Sharks, and other fishes; gulls, gannets, and other birds; and the thousand and one other enemies that lurk in their wake at every stage, from the newly spawned egg to the adult fish.

How tremendous this toll of the other-than-man enemies of the Herring actually is may be gathered from the statement that man himself is credited with an annual catch of nearly eleven billion Herring. On that basis we must conclude that over two hundred billion Herring annually fall victims to their enemies in the sea—enough to load a solid fish train reaching around the earth at the Equator.

Huxley has called mankind an association of Herring catchers, and if those



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A TRIO OF STURGEONS TAKEN AT CAVIAR, ON THE DELAWARE RIVER, IN NEW JERSEY

The Sturgeon fishery has been so intense as to make the taking of these fine fish to-day a comparatively rare occurrence. The largest one taken this year measured 10 feet 3 inches long, weighed 450 pounds before being dressed, and yielded 103 pounds of roe. With the meat selling for 50 cents a pound and the roe for $2.75, the fish brought $350.

fish be counted that are caught by fish which feed on them and in turn feed us, he probably has not missed the mark much.

He also reminds us that single schools covering half a dozen square miles may contain more than three billion Herring; yet many schools have been recorded that covered an area of 20 square miles (see text, page 629).

THE MIGRATIONS OF FISHES

The migration of fishes forms one of the most fascinating romances of the sea. We have seen how the Shad, the Salmon, and other species spend their adult lives in the sea and seek fresh water in which to spawn; how others, such as the Eels, spend their lives in rivers and lakes and seek salt water at spawning time.

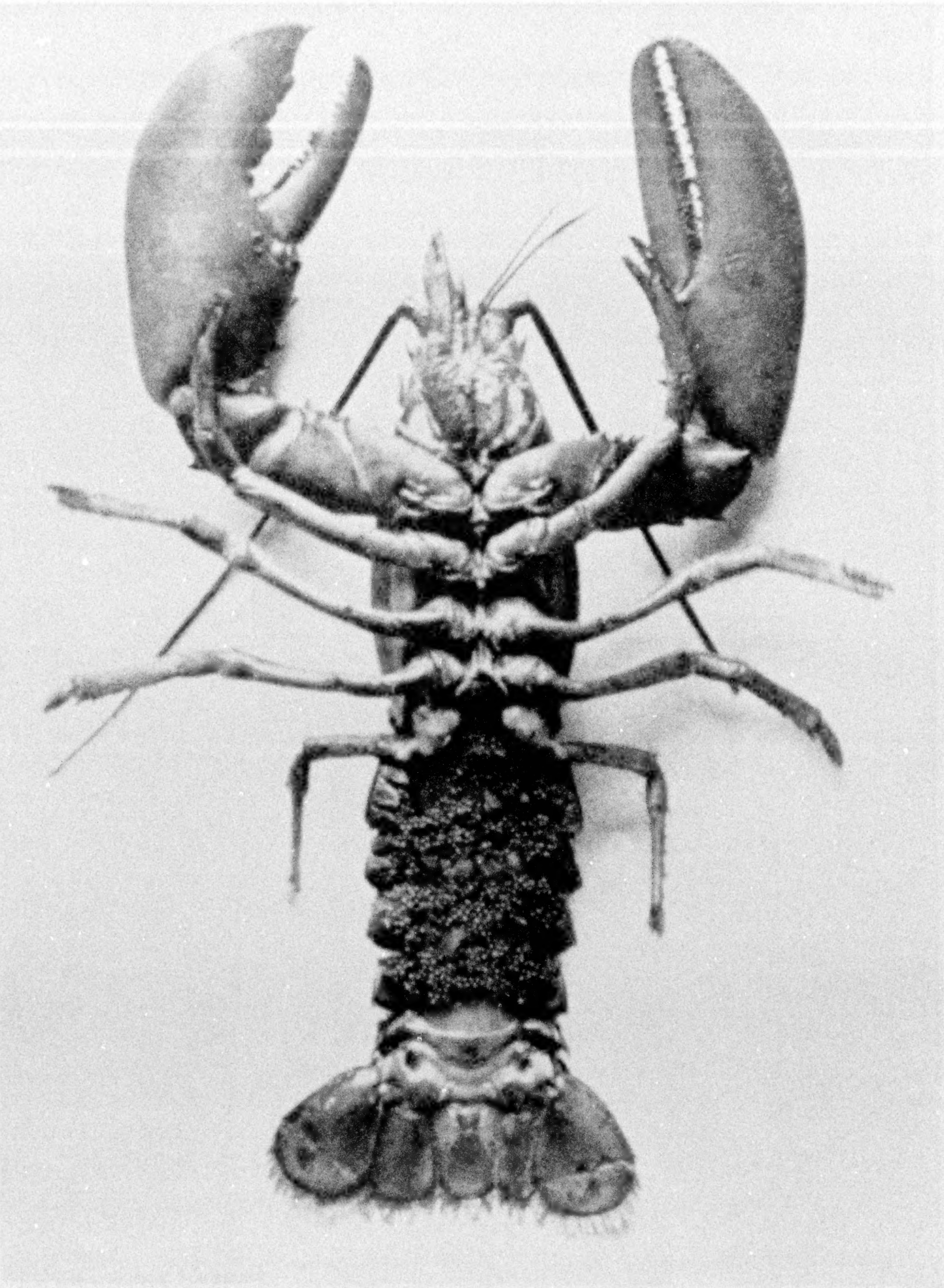
The Mackerel and the Flying Fish families wander wide from their usual haunts at spawning time. Other species follow the great schools of Menhaden about the seas, "a full dinner pail" being their first consideration in their life as in ours.

However, for the most part, keeping a complete check on the movement of the fishes of the seas is a problem still awaiting solution. The exact winter home of the common Mackerel is unknown, though a few have been caught with Cod lines in deep water off Grand Manan, and others have been taken from the stomachs of Cod on Georges and La Have Banks, as well as off the coast of New Jersey.

For a long time it was supposed that the Hickory Shad spawned in Chesapeake Bay, but investigations in that region from 1912 to 1922 failed to reveal a single member of the species under six inches long present in those waters. Its spawning grounds have not been located.

Likewise, the spawning grounds of the Red Tunny have never been discovered. This fish has successfully eluded every effort to trace its tracks through the deep seas.

So, also, is it with the Squeteague, or Weakfish. Appearing in Chesapeake and Delaware Bay waters in April, and in



Photograph from Bureau of Fisheries

A FEMALE LOBSTER "IN BERRY"

The number of eggs produced by a female Lobster varies from 3,000 to 75,000, according to its size and age. They are glued to the undersurface of her body, and carried around for about ten months before hatching (see text, page 583).

LOADING SARDINES FROM A WEIR TRAP INTO BOATS: NEW BRUNSWICK

Though fish are not commonly regarded as meat, there is no characteristic difference between fish flesh and that of animals. Protein and water form the bulk of fish flesh, and, pound for pound, there is almost as much protein in fish meat as in beefsteak. Oily fish, such as Shad, Herring, and Eel, are especially nutritious. Fish roe usually contains more protein than beef and some fat in addition.

Buzzards Bay in May, they stay until October, but where they go then is still a secret of their own.

The migratory movements of Herring are so complex that, although ichthyologists have been trying to fathom the mystery for many years, a complete solution has not yet been found.

TAGS TO TELL THEIR STORIES

During the past summer the United States Bureau of Fisheries decided to make a careful study of the migrations of the Cod, the Pollock, and the Haddock.

It has been tagging 10,000 of these fish—about 80 per cent Cod, 15 per cent Pollock, and 5 per cent Haddock—and turning them loose, in the hope that the fishermen of the waters they inhabit will return the tags of those caught, with information about the locality in which they were taken, a record of the date, and of their size (see page 578).

For each tag returned, the fisherman receives 25 cents and the thanks of the Bureau of Fisheries.

In the tagging operations the fish are caught with hook and line at a depth of not more than 20 fathoms. The uninjured fish is laid on a wet board, measured, and its exact length recorded. A metal tag stamped U. S. B. F. is then securely attached to the upper part of the tail, near the base, and the fish is released after a record is made of its number, its size, where released, etc. It is confidently expected that many fishermen will go to the trouble of assisting the Government by reporting to Washington when such fish are taken.

SIDE LIGHTS ON THE EVOLUTION OF FISHES

A study of the anatomy of fishes and the evolution of some of their organs throws an interesting light on life in the ocean.

In order to see under the water, the eyes of the fish had to be constructed on lines differing somewhat from those of man and land animals. Cutting open a fish's eye, one discovers that the crystalline lens is almost a perfect sphere instead of the somewhat flattened lens of land animals. This arrangement is necessary to sight in the water, since the difference in density between the lens and the water is so slight. The result is that fish are extremely nearsighted.

The fish's power of hearing is decidedly muffled, and it is believed that what we know as the ears are solely organs of equilibration, as they partially are in man.

The sense of taste appears to be largely wanting in fish. Their tongues are without power of motion and lack delicate membranes. They swallow their food very rapidly and usually without mastication, further than getting it small enough to gulp it down.

Air dissolved in water offers fish what little oxygen they need, and the oversupply they get when out of water is fatal to most species, though some, like the Catfishes, can live for a considerable time out of their native element. A man uses thousands of times as much oxygen as a fish.

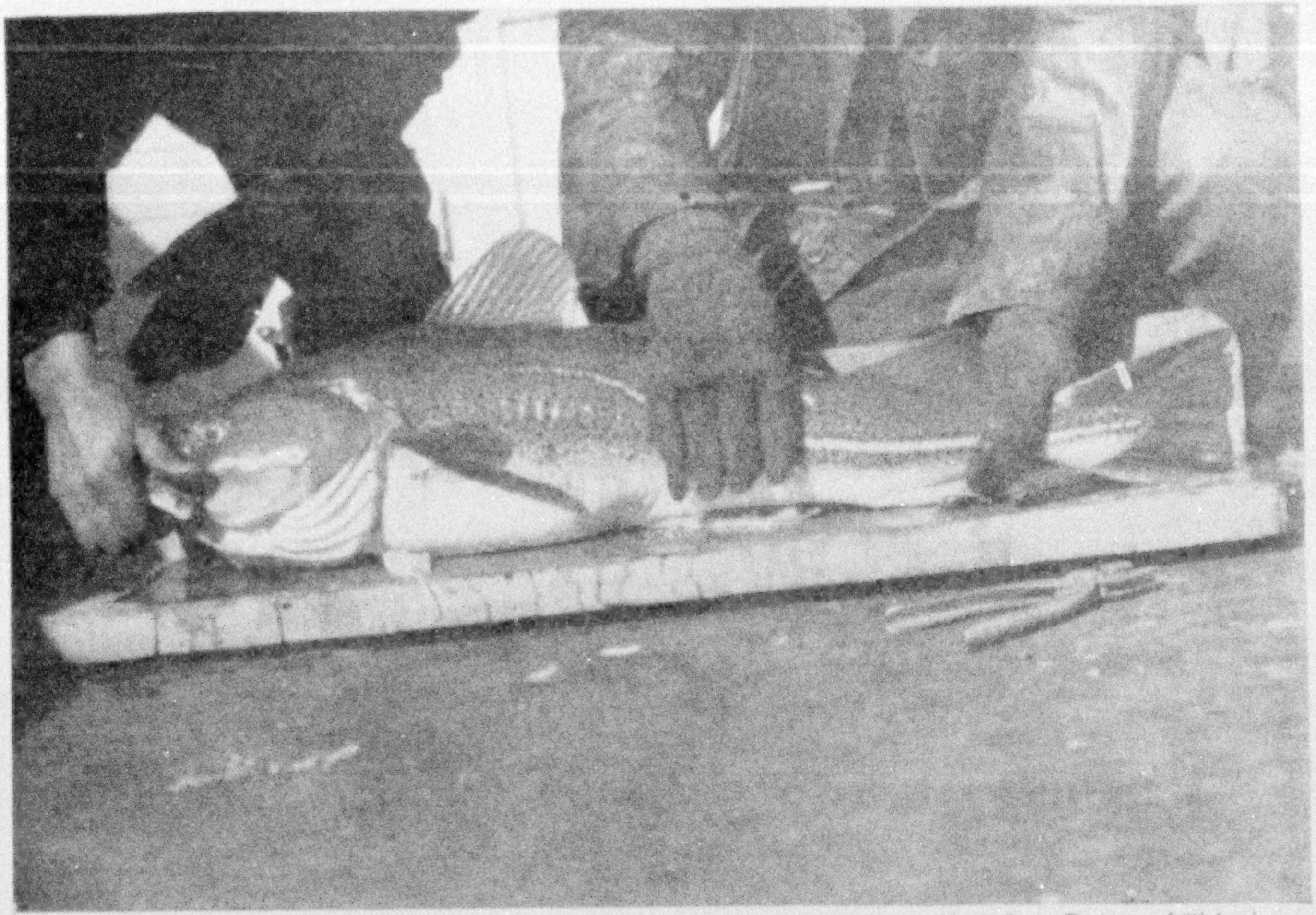
THE EVOLUTION OF THE AIR BLADDER

The air bladders or swim bladders of fishes help them to solve their respective problems of hydrostatics admirably. Bottom fishes have small ones and species that range between the surface and the bottom have relatively large ones. The gas with which air bladders are filled is secreted from the blood in most species.

The evolution of the air bladder from a lung and the perfection of the gills to a point where they furnish oxygen enough, and therefore render lungs useless, may be traced in species still existing. In more primitive fishes the air bladder has a tube connecting it with the throat, and instead of being an empty, gas-filled, sealed sac, it is a true lung, made up of many lobes and parts and lined with a network of small blood vessels. The Gar Pike has a lunglike air bladder, and gulps air from the surface of the water. As the oxygen-assimilating gills develop in going up the scale of fish evolution, the air bladder becomes more a float and less a lung, until the latter use entirely disappears.

THE FUNCTION OF FINS

The major fins of fishes correspond strikingly to the limbs of land mammals. Those back of the gills are known as the pectoral fins and correspond to the arms



Photograph from Bureau of Fisheries

THE GENTLE ART OF TAGGING FISH

Government scientists have been doing noteworthy work in investigating the life habits of migratory food fishes by taking thousands of them, placing identification tags on their tails, and then liberating them. Wet gloves are worn by the experts during the operations because dry hands remove the glutinous veil from the scales of the fishes and expose them to the attacks of many forms of parasites.

of humans. If the bones to which they are attached are examined critically, they will be found somewhat similar to the shoulder girdle of land mammals.

Below the pectoral fins are the ventral fins, which correspond to the hind legs of quadrupeds. The dorsal fin on the back, the caudal fin at the root of the tail, and the anal fin beneath the body are used to maintain equilibrium or direction.

NATURE'S BREEDING METHODS

Nowhere is the art of camouflage more strikingly employed than in marine life. The master breeder of the ages, Nature, has provided highly certain, if very slow, methods of eliminating the unfit from reproduction.

One method is by tests of brute strength, as in the battles of bull seals; another is by the elimination of the sluggards, as in the pursuit of the Herring by the Mackerel. A thousand and one methods are available.

None is more nearly certain among fishes than that which removes those failing to make proper use of the art of camouflage. Note the hues of a Herring in the color section (see Color Plate IX). Its back corresponds to the shades of the water in which it thrives; viewed from the air, it has low visibility. Its belly corresponds to the appearance of water when viewed from beneath the surface. The fishes best protected by their camouflage escape their enemies most frequently, and therefore have a better chance to reproduce. The ones that are least protected fall victims more easily, and therefore are less likely to reproduce.

So, even if ever so little in each generation, the process goes on—ever the better fitting each and every thing that reproduces life to the environment in which its fortunes are cast.

USING THE ART OF CAMOUFLAGE

The Flounder, the Halibut, or the Sand Dab, lying on the sand, has harmonizing blotches imprinted all over the upper part

SPECIAL
RUSH

HOW THE SPORTY SALMON COMES FRESH TO AMERICAN DINNER TABLES

Each of the beautiful specimens from the fishing communities of our northern coasts and Canada rides into American markets in a special berth padded in frazil ice and snow, and thereby is unharmed and delicious when it arrives. Fish packed by this method have been shipped 800 miles inland without showing signs of deterioration.

of its body, imitating the various kinds of sand on which it lies, whether that be common brown sand, crushed coral, or rotting lava. The least successfully camouflaged individuals face the greatest peril and the most successfully concealed ones enjoy the greatest safety.

Man's success in breeding horns off the ox, the long nose off the wild boar, and great size into draft horses, are but a few passing examples of throwing Nature's processes into high gear and hastening the transformation. He has done less in this respect with the fishes than with almost any other form of life, for the reason that he has had less control over them.

But, even at that, he has been able to breed pugnacity into fishes, as witness the fighting fish of Siam, where the natives have fish fights as exciting to them as are cockfights to the masses in Spanish America.

While not a fish, the Lobster, belonging to the crustacean group of animals, supports one of the most interesting and important fisheries of the American shores of the North Atlantic.

The Lobster, biologically, is a closer relative of the spider than of the fish, and the problem of saving the Lobster fisheries from utter depletion is one of the most difficult with which the fish culturists have to deal.

THE LOBSTER'S HABITS

The American Lobster (see Color Plate XVI) is found only on the eastern coast of the United States. Its known range covers a strip of the North Atlantic ocean reaching from Labrador to North Carolina, with the Maine and lower Canadian shores as the region of its greatest commercial abundance. This strip of water is from 30 to 50 miles wide and from 6 to 600 feet deep.

From the close of its early free pelagic life to its old age, which often stretches into decades, the Lobster never leaves the sea bottom of its own accord. Its external world is the ocean floor, and it is content to stay there.

Photograph by H. Armstrong Roberts

DRYING NETS NEAR THE VIRGINIA CAPES

Important industries have arisen from the by-products of American fisheries. One of the oldest is the fish-scrap industry, utilizing the offal for fertilizer and for chicken and cattle food. Fish oils, used in the manufacture of cheap soaps, lubricants, and paints; Cod-liver oil, valuable medicinally; North American isinglass, used in clarifying certain beverages, in making adhesives, India ink, and a sizing for textile goods; glues and cements, are other by-products. Last year, workers in Toronto University discovered that "insulin," prepared from the pancreas of the Shark, was useful as a palliative for diabetes.

Having considerable power of locomotion, it wanders around as winter approaches, from the shallow inshore waters to the deeper ones of the 100-fathom line, searching for water of comfortable temperature and for suitable food, and attending to the duties of reproduction.

Its instincts constantly lead it to conceal itself, sometimes to take its prey unawares, and at others to hide from its natural enemies.

THE FOOD OF THE LOBSTER

It walks over the sea floor on its slender legs, which are provided with brushes of sensitive hairs. With its large claws put forward to offer little resistance to the water, it keeps its "feelers" waving back and forth continually to detect danger as well as to discover game its eyes may have overlooked.

The buoyancy of the water makes the Lobster light on its feet in its native environment, but its body weight is too great for its legs when out of water.

Though a great scavenger and tending to be nocturnal in its search for food, it is believed that the Lobster prefers fresh food whenever that is available. Fresh Codfish heads, Flatfish, Sculpins, Sea Robins, Menhadens, and Haddocks make excellent bait, but balls of putrid, slack-salted Herring seem just as attractive.

When hungry, the big crustacean will burrow in the sand like a ravenous pig rooting for grubs, and it has been known to attack even a full-sized Conch, breaking its shell away, piece by piece, and gluttonously devouring the soft parts.

The Lobster is a cannibal by nature, preying on its weaker brethren, and did not the conditions under which it is hatched favor its immediate and wide dispersion, it would largely exterminate itself.

BATTLES WITHOUT QUARTER

Like dogs, Lobsters have frequently been observed to drag dead prey to some secret spot, bury it, and then mount guard over the cache, ready to defend it against all comers. And often many grim battles are fought over such caches. Indeed, few of the giant Lobsters that have been taken are without numerous scars that tell in no uncertain language of pitiless struggles to which they have been party, where quarter was neither asked nor given.

In the American Museum of Natural History in New York a giant Lobster is preserved whose living weight was 34 pounds. It was captured at Atlantic Highlands in 1897. The Smithsonian Institution has one whose living weight is estimated at 25 pounds.

Dr. F. H. Herrick, the author of the United States Bureau of Fisheries' striking study of the American Lobster, thinks that all of the thirteen titans he lists as weighing more than 20 pounds were not giants by nature, but rather simple favorites of fate, which allowed them to live to a riper age than their smaller fellow-creatures. Good luck never deserted them until they became stranded on some inhospitable beach or entangled in some fisherman's gear. Such Lobsters as these, he believes, have weathered the perils of at least half a century.

THE MOLTS OF THE LOBSTER

Few living creatures have such striking habits of changing their clothes as the Lobster. It begins to molt or discard its outgrown clothes the second day after hatching, and continues to do so with decreasing frequency until it has ceased to grow at all.

Nowhere else in Nature is the molting process so striking, so critical, or so abrupt.

When the old shell becomes too small a new skin begins to grow underneath it. When this growth nears completion the Lobster becomes a "shedder," ready to cast off not only its old shell, but even the lining of its esophagus, stomach, and intestine.

Restless and uneasy as the molt approaches, there comes a break where the tail joins the shell. The Lobster then turns over on its side, bends itself in the shape of a "V," with the break at the apex. Pressure is applied, and gradually the rear end of the old shell breaks loose from the new one beneath.

Step by step the process of liberating the imprisoned body from its outgrown armor sweeps forward, until finally the claws are withdrawn through the narrow openings. Presently, with a mighty effort, the Lobster emerges from its old coat of mail, casts off the linings of its digestive tract, and steps out, full-panoplied in a soft new shell.

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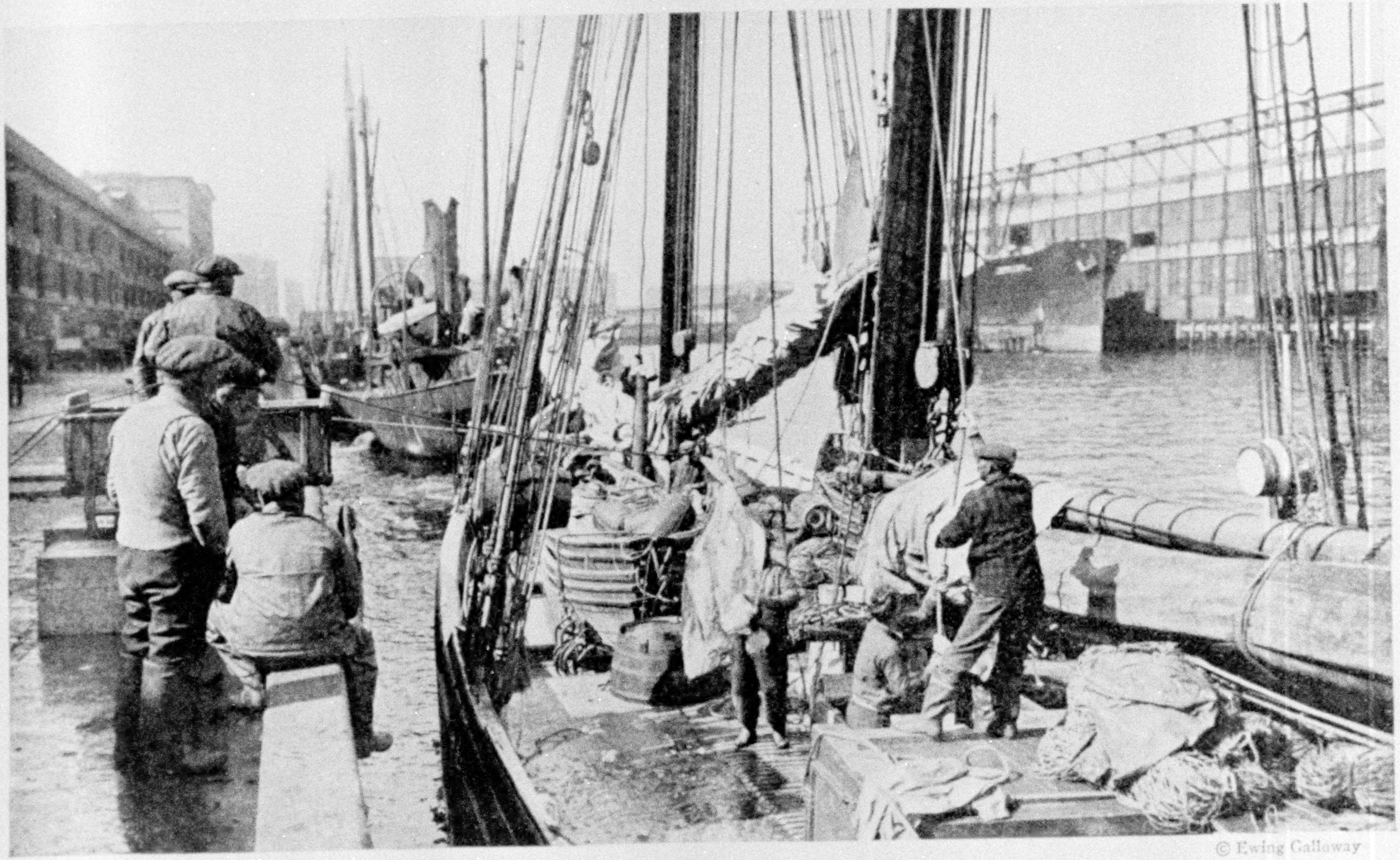

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UNLOADING HALIBUT: BOSTON, MASSACHUSETTS

In the Gulf of Maine the Halibut has been seriously depleted by overfishing, but fortunately it has been discovered in such abundance along the deeper slopes of the Banks that at first it appeared inexhaustible. New England Halibut fishermen have operated for years in the neighborhood of Sable Island.

The area of a cross section of the flesh in the largest part of one of its big claws is four times greater than that of a cross section of the second joint, through which it must be drawn. The process, therefore, reminds one of pulling wire through the holes of a drawplate.

From six weeks to three months are required for the soft-shelled Lobster to become a hard-shelled one again.

ENEMIES OF THE LOBSTER

The Lobster has many enemies, but, next to man and his alluring traps, the Codfish ranks as its worst foe. With an appetite that doesn't stop at a hard shell up to eight inches, and with a particular taste for young Lobsters from two to four inches in size, the Codfish is a tremendous competitor of the Lobster palace.

During their younger lives, Lobsters play into the hands of millions of foes in the sea, for it is not until the fourth or fifth stage that they leave the surface for the bottom. It is not until this period that caution seems to dawn in them and guide them to hiding places on the sea floor. In this care-free period vast schools of surface-feeding fish strain the water through which they chance to pass as effectively as might a towed net.

MESSMATES PRESENT THEMSELVES

Though only a few parasites of the Lobster are known, it has many messmates. Barnacles affix themselves to its shell and cement their tentlike coverings thereon; various kinds of Mussels insinuate themselves into attractive depressions in the carapace and joints. Tunicata sometimes fasten themselves on the undersurface of the body, between the legs. Tube-forming Annelida, lacelike Bryozoa, and various forms of algæ make themselves unbidden guests, which the uneasy host can cast off only when it molts.

Grain-eating birds swallow their food whole and, with the aid of gravel or other hard material, pulverize it in their gizzards. The Lobster handles the situation differently. It chews its food before passing it into its mouth. The cutting teeth of its outer mouth parts chop the material into mincemeat, which is passed into the mouth proper in a slow stream of fine particles. From there the food reaches the stomach, which is divided into two parts—the forward section for storage and the rear compartment for sorting, straining, and digesting the food. Between the two are three teeth, one upper and two lower, which, like upper and nether millstones, grind the food to its appropriate degree of fineness.

When one examines a Lobster carefully it is seen that the two great claws do not terminate alike. The one ends with a large crushing type of pincers and the other with a seizing type. One of the strange things in connection with these great claws is that Nature has given the Lobster power not only to amputate them in case of danger, but to grow others in their place after amputation occurs.

WHAT SELF-AMPUTATION MEANS

Imagine a man with his hand caught in a machine suddenly giving a severe jerk and severing his arm at the elbow! And then imagine him going off to himself and growing another arm to take the place of the lost one! That is comparable to what the Lobster does.

In a census of more than 700 Lobsters, 7 per cent were found to have thrown one or both great claws, and these showed every stage of the regenerative process. Nature has arranged matters so that no tendons or large blood vessels cross the breaking point, hence there is little bleeding at the operation.

That the self-amputation of the claw is a matter of will is shown by the fact that when put under an anæsthetic, the Lobster "forgets" to amputate the captive member.

GLUING HER EGGS FAST TO HER BODY

When the female Lobster lays her eggs she turns over on her back, using her large claws and her tail-fan as a tripod to support herself. She flexes her abdomen to make a sort of pocket, to which she glues the eggs fast. An 8-inch female will lay about 5,000 eggs, a 10-inch individual about 10,000, and a 19-inch one some 75,000, there being about 6,000 eggs to the ounce (see page 575).

The eggs are carried about for ten months. After hatching, the larvæ spend from three to five weeks irresponsibly floating around near the surface, somewhat lacking in the powers of coördina-

XUM

PACKING SARDINES IN CANADA

Sardine packing had an early origin on the Maine coast as a more lucrative outgrowth of the Herring industry. The quantity of canned fish has increased by leaps and bounds, Salmon ranking first and the Sardine second. The total value of canned fishery products was more than $46,000,000 in 1921.

tion and orientation. During this time they undergo four molts. At the third molt after hatching the Lobsters begin to take on the characteristics of the adult. At this stage the instinct to desert the surface and seek the bottom suddenly asserts itself, and the Lobsterling settles down to its new environment to eat and grow, reaching maturity in five or six years.

MANY MYSTERIES OF THE SEA

While the ocean literally teems with life, man has learned to make comparatively small use of it, and the list of fishes fit for food is infinitely longer than the list of food fishes. The things yet to be found out about marine creatures are vastly more numerous than the things already discovered.

Imagine a race living somewhere on table-lands towering above our atmosphere, and possessing craft lighter than swan's-down; and then imagine them launching out on the surface of the oceans of air, with clouds forever shutting out a view of the earth below.

Now and then one of their craft might drop a dredge. The sounding tube might sink into the soil of a cornfield or the mud of a river bank.

The dredge might capture a bumblebee

Photograph from Ewing Galloway

A FOUR-TON STACK OF FISH IN NOVA SCOTIA

In the northern regions of the earth where man must necessarily be frugal, no portion of fishes rich in oil, such for instance, as the Cod, is ever wasted. Norwegians mix Cod-heads in the food of their cows for the purpose of making them give richer milk. Icelanders give the bones of the Cod to their cattle, and the inhabitants of the Peninsula of Kamchatka give them to their dogs.

or a butterfly. It might conceivably get a field mouse or a pine cone. But, whatever it got, how little that would be compared with the vast number of things that would escape!

LIFE UNDER INCONCEIVABLE PRESSURE

And so it is with our knowledge of the sea and the vast numbers of creatures that inhabit its depths! Even on the floor of the deepest trench in the abysmal region of the sea's bottom, where no ray of light ever reaches, where Stygian darkness is perpetual, where all but freezing temperatures never cease, and where inconceivable pressures prevail, the miracle of life still goes on!

In some of the ocean depths the pressure exerted would be equal to that of a block of limestone three feet square and six feet high resting on a square inch of surface. A creature five feet long with an average girth of four feet would have to sustain a pressure of some 20,000 tons.

In size the denizens of the deep seas range from microscopic to mammoth creatures. Occasionally huge hulks of flesh of a tough, fibrous nature, unlike

Photograph by Edith S. Watson

FISHWIVES BEHEADING CAPELIN: ISLAND OF ST. PIERRE

The Islands of St. Pierre and Miquelon, ceded by Great Britain to France as shelters for her fishermen by the Treaty of Paris, 1763, are now only relics of the once great French empire in America. Both were formerly very valuable as stations from which France carried on her fisheries on the Banks of Newfoundland. St. Pierre is the smaller, but the more important of the two, and the little town of the same name presents a busy aspect during the fishing season. The American Capelin was so called because early French fishermen saw a resemblance to the European *Capelan*, a small Cod, but the American fish is classed as a Smelt.

that of any known creatures, are washed ashore. One such hulk was 20 feet long, 40 feet around, and weighed many tons. It was believed to be a fragment of some giant of the sea floor, torn loose by a cataclysm of the deep.

RELATIVE AREA AVAILABLE TO MARINE AND LAND FAUNA

The area of the sea is three times that of the land. Its average depth is more than two miles. The sea has 138 times as much territory 12,000 feet below sea-level as the land has 12,000 feet above.

While man and the terrestrial fauna are able to command only the surface of 57,000,000 square miles of land, the marine fauna has 140,000,000 square miles of sea, with scores, if not hundreds, of depth zones over most of this area, each with its own characteristic forms of life. The water level of the oceans would have to be lowered 10,000 feet to bring about an even division of the areas available for life of marine and terrestrial faunas.

With the great existing disproportion in area between the land and the sea, it is evident that the human race, with its seemingly insatiable mass appetite, will have to look more and more to the sea for its food.

THE RESULTS OF OVERFISHING

And yet on every hand one already sees the results of overfishing on many of the species now entering the fish markets.

The anadromous fishes, particularly the Shad and the Salmon, are growing scarcer and higher-priced with each passing year.

Between overfishing and stream pollution, the fresh and brackish coastal waters are seeing their fisheries depleted rapidly toward the vanishing point.

The Atlantic Salmon has disappeared from many rivers. Along the Maine coast the catch has dwindled to one-seventh of what it was in 1889. The Housatonic, the Thames, and the Saugatuck are Connecticut rivers that once were nationally famous for their Salmon, but which now yield none.

The Shad is going the way of the Salmon. The supply in the Potomac and the Susquehanna is gradually declining. In the Connecticut River the catch in 1923 was only one-tenth as large as that of 1903. The Hudson and the Merrimac know this fish no more.

Similarly alarming conditions occur among other species. The Smelt has disappeared from the Naugatuck, the Striped Bass from the lower Hudson and the East River. Twenty years ago as many Weakfish were caught off the northern New Jersey shore in a week as now are taken in a season.

The same condition prevails in the shellfish fisheries. Oysters are disappearing from beds where once they were plentiful in spite of Governmental and State watchfulness.

THE DECLINE OF THE LOBSTER FISHERY

The story of the constant yearly depletion of the Lobster fishery is told in every area where the fishery exists.

In colonial times Lobsters were so plentiful that even the poorest of the people might feast to their heart's content on this succulent crustacean.

Even as late as 1889 the catch in the United States reached a total of 30,000,000 pounds, which sold for $800,000—less than three cents a pound. Ten years later the catch was only half as large, while the price had more than doubled.

In 1880 Maine produced 14,234,000 pounds, which sold for less than two cents a pound, as compared with 5,545,000 pounds in 1922, which sold at 26 cents a pound at the wharf, and heaven only knows at how much to the ultimate consumer.

The catch of Maine alone, in 1880, was greater than the total catch from Delaware Bay to the Canadian shore in 1922.

THE EFFECT OF STREAM POLLUTION

Where stream pollution is the chief cause of the decline of the fisheries, nothing except radical protective legislation to save the streams will avail. The Government has found that a pound of bark to 30 gallons of water will kill Bass in one day, and that even a pound of chips to seven gallons of water is fatal to Salmon fry.

If such simple pollutions as these destroy fish by the wholesale, what destruction is wrought by oil and tar, sludge and bilge!

Overfishing may be combatted in two ways—by artificial propagation and by restricting the catch, either as to season or as to size—in short, applying common sense.

Artificial propagation has proved its value in the case of fresh-water and anadromous fishes. The Shad fishery continues only because the U. S. Bureau of Fisheries has preserved it by artificial propagation. The same is true of the Salmon.

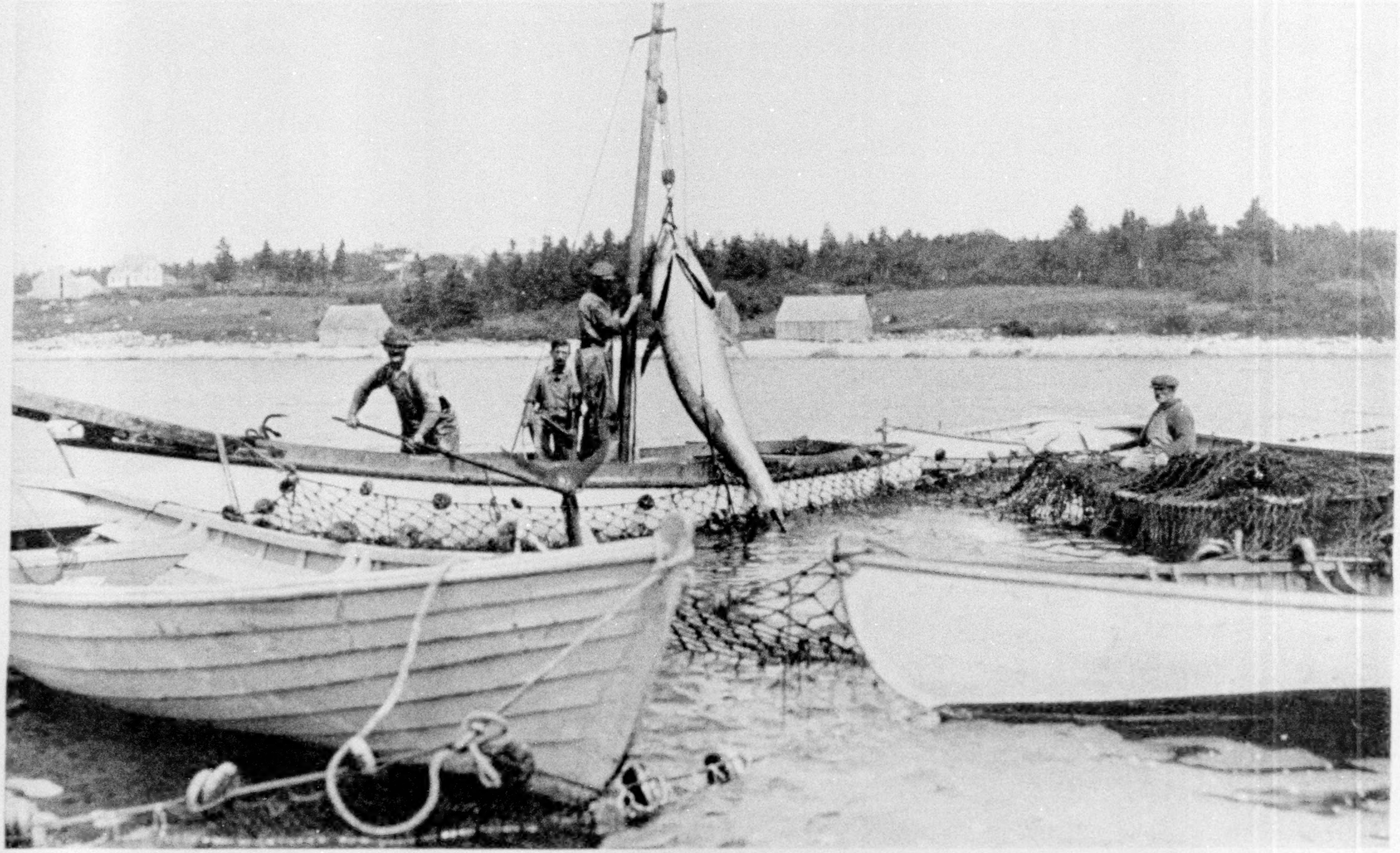
THE "DANGEROUS AGE" IN FISHES

But for marine fishes, authorities differ as to the value of methods at present employed. As new knowledge of the sea is gathered, however, there come reasons to believe that conditions may be established under which artificial propagation can be made a success.

It has been found lately that there is a dangerous age for the fry of fish, just as there is for the children of men. We

A GOOD CATCH IN NOVA SCOTIA

Of the myriad forms of fish life, one of the largest groups is that of the bassalian, or deep-sea fishes, which includes those that live below the line of adequate light. Since they dwell below the influence of the sun's rays, climatic zones and surface temperatures have little relation to them, and the same forms are to be found in the Arctic as under the Equator. These deep-sea fishes are held to be adaptations of forms that once lived close to shore.



HANDLING TUNA: ST. MARGARETS BAY, NOVA SCOTIA

A giant fish being hoisted from the spiller net after it had been killed. Specially constructed boats are used because of the great weights of the Tuna. Before the kill, great care must be used in handling it, since its wide, sinewy, V-shaped tail could crush or capsize a boat.

Photograph by Arnold L. Belcher

PART OF THE FISHING FLEET AT ANCHOR NEAR THE CUSTOMHOUSE TOWER, BOSTON, MASSACHUSETTS

These mosquito craft are a part of the great fishing fleet which landed over 14,000,000 pounds of fishery products on the wharves of the Nation's fishing capital during one representative month in 1922. Distribution of sea food passing through Boston is confined chiefly to Massachusetts and neighboring States, Massachusetts' consumption exceeding one and one-half pounds per capita monthly.

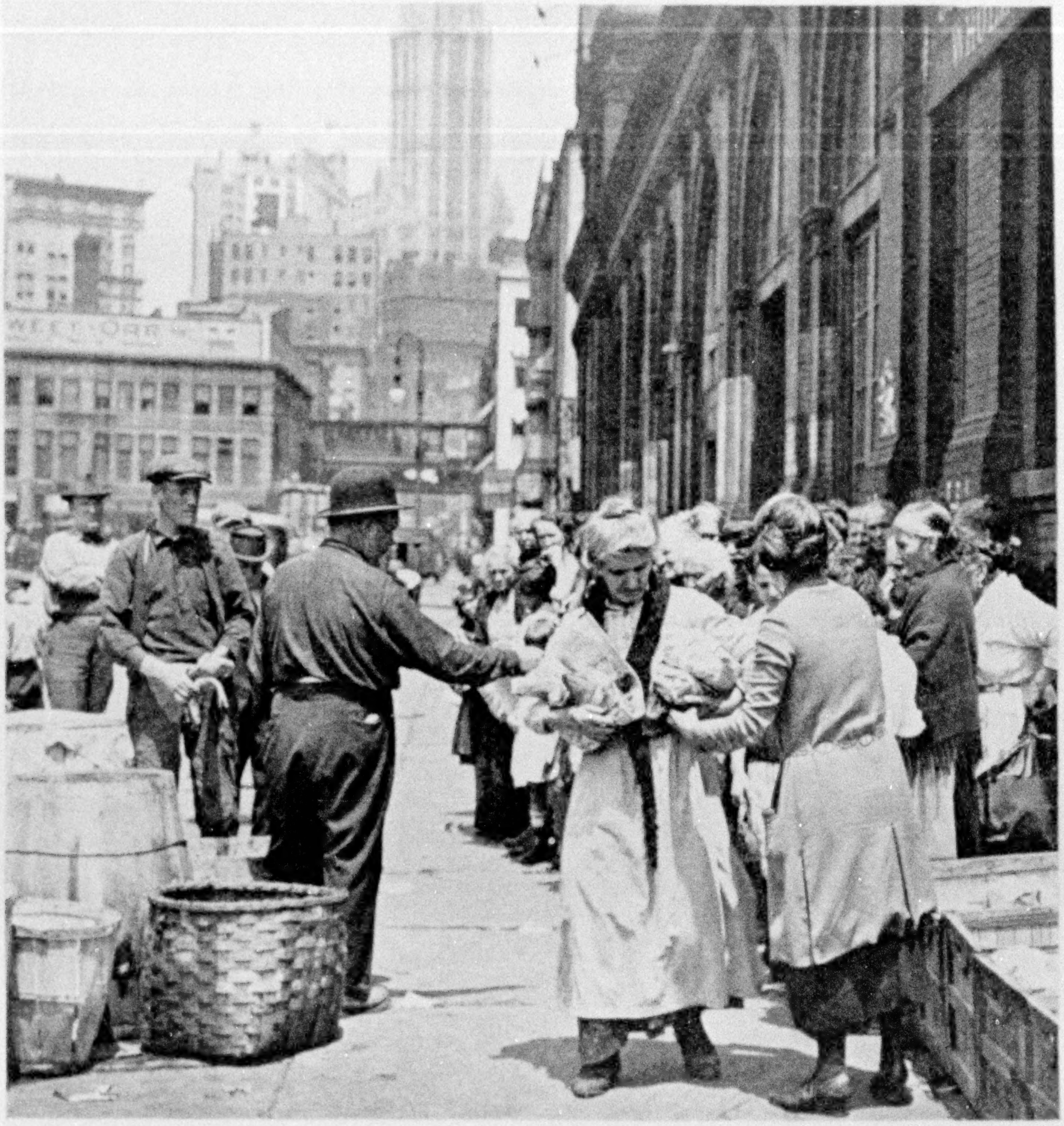
know that more children die between the day of their birth and their second birthday than during the next twenty years, because of the high mortality from diseases of infancy.

Likewise, it has been demonstrated that the first few weeks of a fishling's career constitute a high mortality period, in which thousands die where one survives.

If safe artificial methods could be devised to bring the fry past the critical period, their chances of survival would be vastly improved. It has been found that usually this period of wholesale decimation is reached about the time of the absorption of the yolk sac.

PLANKTON AND ITS RELATION TO FISH LIFE

Apparently at or before this stage minute forms of plankton—the mass of



© Ewing Galloway

WITH LOAVES AND FISHES HE FEEDS HUNGRY HUNDREDS IN NEW YORK CITY

Down near Fulton Market, in New York City, once a week a truckman gives large quantities of fish and bread to women from very poor homes in the vicinity. This picture shows the distributor and his assistant supplying a long line of women and children waiting beneath the shadows of some of the city's largest financial institutions.

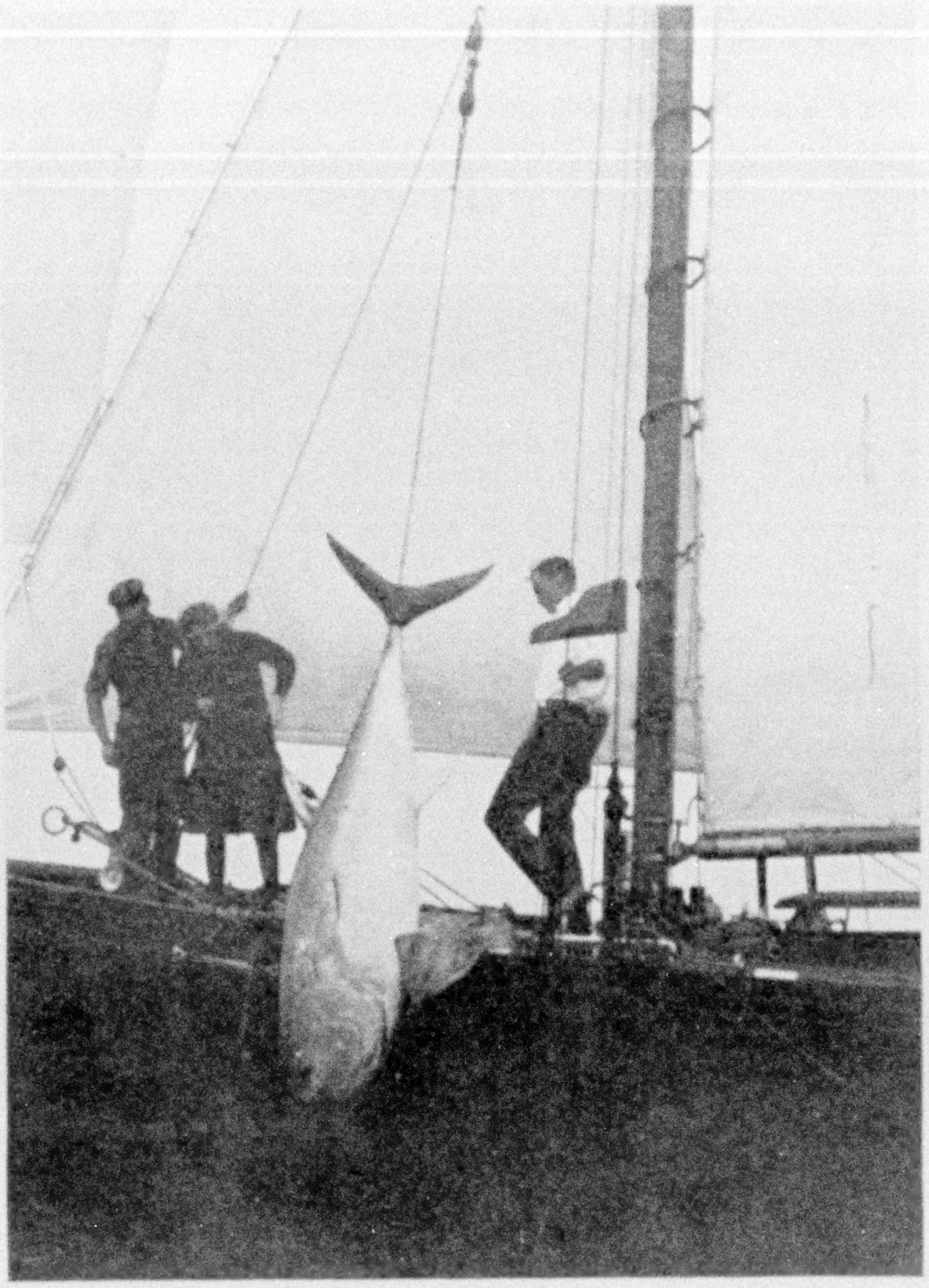
passively floating or weakly swimming plant and animal life near the surface of the sea—are needed as food by the fry that can no longer draw on the yolk sac for nourishment, and without this plankton they die.

The scarcity or abundance of plankton has been found to depend upon sunlight and temperature, and the examination of the scales of fish reveals that in any school of adults there is a great preponderance of some particular age. Figuring back, this class coincides with the year most favorable to the development of plankton.

This affords a clue to the discovery of a method by which marine hatcheries may bring their salt-water fry past the dangerous age before releasing them—a thing that cannot now be done.

This line of investigation shows how important the study of marine life is, what invaluable revelations it may yield, and the splendid character of the results that may be attained therefrom.

The United States Bureau of Fisheries



Photograph by Gilbert Grosvenor

LANDING GIANT TUNA FISH, CAPE BRETON ISLAND

The North Atlantic Tuna is the giant of his tribe, specimens weighing as much as 1,500 pounds having been captured. European varieties do not attain more than 500 pounds, and on the California coast they are still smaller. In the Old World the Tuna has been prized as food since the time of the ancient Romans, but it was long in gaining popularity in this country. The American canned Tuna industry is comparatively new.

has recently published a paper on the Lobster which shows how an understanding of marine life leads to a solution of the problem of its conservation.

SAVING THE LOBSTER FISHERY

To meet the alarming decline of the Lobster fishery, the several States interested in its protection have enacted various laws. Some have provisions for a closed season, in which the taking of this crustacean is forbidden. Laws prohibiting the destruction of female Lobsters "in berry"—that is, carrying their eggs after laying them—have also been enacted.

In addition to the protection thus offered, attempts have been made to propagate them artificially, by hatching and liberating the fry.

Existing policies, however, have not checked the decline, and recent studies show that new forms of protection and propagation must be adopted if the fishery is to be saved. Dr. Herrick, America's foremost student of the Lobster problem, proposes the abolition of the closed season, which he considers a futile practice. He would adopt a double gauge, under which traps would be prohibited that did not permit the escape of all Lobsters under 9 inches, and make impossible the entrance of all over 11 inches. He also would forbid the capture or sale of all below or above that limit; would protect the "berried" Lobster and fix a bounty for each one delivered to the fishery authorities. He would have young Lobsters reared to the bottom-seeking stage in hatcheries, thus liberating them when the perils of infancy are past.

FISHES OF GEOLOGIC HISTORY

Jordan observes that when a fish dies it leaves no friends. Its body is promptly attacked by scores of scavengers, ranging from the one-celled Protozoa and bacteria to members of its own species. The flesh is soon devoured, the gelatinous substance of the bones decays and leaves the phosphate of lime content to be absorbed by the water. Hence the multitudes die without leaving any trace behind. Once in a great while a few teeth, or a fin spine, or a bone buried in clay may endure, but the exceptions are notably rare.

It is because of this condition that few traces of the earliest fishes of the geologic past have been left. An expedition from the Smithsonian Institution, some years ago, unearthed, near Cañon City, Colorado, what are believed to be the oldest fish remains known to science. They come down from the Lower Silurian age, a time when neither man nor mammal, nor reptile, nor any other living land animal with a backbone, had yet appeared—a time, indeed, when some of the deepest sandstones we know were being laid down.

FORCES OF DISTRIBUTION STILL AT WORK

From early geologic times many things have played important rôles in determining the distribution of the various species of fish. We see those same forces at work to-day.

In New England waters only a beggarly 34,000 pounds of Bluefish are taken annually, while from there to Delaware Bay the yearly catch amounts to more than 3,000,000 pounds.

In the case of Cod, the situation is reversed, there being some eighty times as many Cod taken north of Long Island as south of that latitude.

There are practically no Croakers in New England, but a plentiful supply off the New Jersey shore.

There are few Herring in waters between Long Island Sound and Delaware Bay, while the Menhaden are most abundant there. Temperature is regarded as the principal influence in thus separating the fishes in these two parts of our North Atlantic waters. There are some species that seem to be equally at home above or below the latitude of Long Island, such as the Alewife, the Butter-fish, the Summer Flounder, and the Scup.

BOSTON, CENTER OF AMERICA'S FISHERIES

Boston is easily the fishing capital of the New World, and yields only to Grimsby, England, as the world's leading fishing port (see illustrations, pages 582 and 590).

In the North Atlantic fisheries, Canada has 43,000 men employed, as against 76,000 for New England and the Middle Atlantic States.

In the United States fisheries north of Delaware Bay, the Menhaden takes first rank in the weight of the catch, with 256,000,000 pounds to its credit.

There is a wide gap between it and the next group, which includes the Herring, Haddock and Cod, with 98,000,000, 89,000,000, and 86,000,000 pounds, respectively, as the weights of their annual catches.

Then there is another wide gap, followed by another group, which includes the Pollock, with 25,000,000 pounds; the Flounder, with 22,000,000; the Hake, with 21,000,000; and the Whiting, with 20,000,000 pounds.

The Mackerel leads the fourth group with 17,000,000 pounds, the Weakfish and the Scup following second and third.

The Alewives head the group of four next in importance, with 5,000,000 pounds. The Butter-fish, the Croaker, and the Bluefish contribute 4,600,000 pounds, 4,236,000 pounds, and 3,362,000 pounds, respectively, to the total catch.

The Cusk and the Bonito are the other species that show an annual catch of more than 2,000,000 pounds.

THE ERA OF CHOICE FOODS

The Lobster fishery yields over 12,000,000 pounds, nearly half of the product being taken from the Lobster pots of Maine.

The abounding wealth of the United States and the high per capita income of the people have made them able to indulge their whims rather than their needs for food. Therefore the food they select, both from land and sea, has been chosen more from the standpoint of flavor than from that of nourishing qualities. The choice cuts of beef and the choice varieties of fish are taken and the remainder all but discarded.

They have been particularly slow to adopt new salt-water fishes into their diet. What was ignored yesterday comes into the market to-day, and to-morrow it acquires a vogue.

It is not so long ago that the Pollock

© H. Armstrong Roberts

AN ATLANTIC FISHERMAN MENDING HIS NETS

The gear with which the ocean fishermen comb the seas for food for man is of many kinds and of divers types. The capital invested in the fishing fleets of the North Atlantic is in the neighborhood of $100,000,000.

was in such small demand that it was scarcely worth the taking. So also with the Tuna. But to-day both find ready sale, the latter particularly in cans.

The Flounder, likewise, used to be eaten only by the initiated few; but now it is one of the most ready sellers. So it has been with the Haddock and the minor Salmons.

TRAINING THE NATIONAL TASTE

Sea Mussels and Tilefish (see Color Plate XV) show how the public taste can be trained under proper guidance, and as the population of the country grows we shall follow Europe in the utilization of marine resources to supplement our land crops. To-day we eat only about a third as much fish per capita as the people of Europe, and have only scratched the surface in promoting the utilization of our food-fish resources.

We have overfished a few of our species, but the great majority have barely been touched. Even those which constitute our principal fisheries are yielding, with a few exceptions, only a fraction of what they could offer, if marketing facilities were better.

Three basic handicaps—perishability of the product, unevenness or uncertainty of supply, and unsteady consumer demand—have kept the fresh-fish industry from developing as it should.

FRESH FISH TO EVERY MARKET

Other products have one or two of these handicaps: milk is perishable, but considered imperative; canned goods have an uneven demand and supply, but only fish suffer from all three conditions.

But lately ways are being discovered to overcome the perishability of fish. Methods of precooling have been found in which the fish can be frozen as soon as taken, in low-temperatured brine, insuring the thorough cooling of every shred before chemical change sets in.

Then the fish is encased in an individual film of ice and sent to market. The housewife who buys her fish in this ice jacket can then know it is perfectly fresh, having been kept so from the hour it was caught.

A fresh fish bought in a market stall is seldom as fresh as a frozen fish precooled when caught, and once this type of frozen fish becomes widely available, it is safe to predict that the zone in which marine fishes are eaten fresh will reach much farther back from the coast than it now does.

Other methods of securing new patrons of the marine fisheries have been tried with success. Last winter two Boston wholesale fish dealers tried putting up choice cuts of Haddock in consumer packages wrapped in parchment paper. The experiment was so successful that these packages have found favor as far away as Denver.

A Boston forwarder took a step in another direction in the extension of the fresh-fish market. He undertook to gather the less-than-carload lots of fish consigned to Philadelphia or other cities and to ship them through in carload lots with a large saving of transportation costs and increased expedition in handling.

SHIPPING LIVE FISH TO MARKET

A Canadian fisherman has tried shipping live Lake Trout to New York, with striking success. He sent in one shipment 6,000 pounds of Trout. They were put in four wooden tanks seven feet square and five feet deep, which were placed in an ordinary box car. By means of a kerosene-driven engine the water was kept constantly in circulation. Casualties in transportation were only about 15 per cent, and it is possible that in the future the fastidious can enter their favorite restaurants, peer into a pool, and select the fishes they want to eat—that is, if the demand is great enough to warrant the regular deliveries.

That fish from the sea will help solve the food problem of America whenever it becomes acute is shown by the fact that analyses reveal how readily fish can be used as a substitute for meat.

Fresh Salmon has more nutrients in it, for instance, than round steak; Shad, more than chicken.

THE DAY OF FISH FARMING

There are some six million farms in the United States, and as the demand for food grows more pressing, each will probably have its own fish pond. Assuming that each farm will utilize only three pounds of fish a week, a total of more than a billion pounds would be available.

XUM

© Ewing Galloway

BUYERS MATCHING FINGERS IN THE DIVISION OF BARRELS OF FISH AMONG THEM

"Mora," or finger matching, is a very old Italian game. It is played either for wagers or for fun and the Italians are very skillful at it. Shore Haddock, landed only a few hours after being caught, enjoy an eager demand at twice the price of offshore Haddock.

releasing a nearly equivalent amount of other meat for urban consumption.

The United States Bureau of Fisheries has foreseen the day when exact knowledge of the marine and fresh-water conditions that make for an abundant fish supply will be one of our major concerns.

It recognizes that without exact and definite knowledge of all phases of marine biology that affect the lives of the fishes suitable for human consumption, efforts to utilize the food resources of the sea to the fullest advantage must be handicapped so sorely that species which might render rich returns will be neglected, while others that have met with great favor may be all but exterminated.

The Bureau's work in introducing the Shad into Pacific waters and making it abundant through 2,000 miles of coastline has been a service of the first order. Its success in saving the Atlantic Salmon and the Shad from extermination in such eastern rivers as have not reached the critical stage of pollution is another instance of its unusual value to the nation. Its rescue of the Seal fishery from destruction and its protection of the Alaskan Salmon fishery from inordinate depletion have earned for it a universal appreciation.

Yet these activities are but a prelude to the things that remain to be done.

Thanks to the splendid achievements of the past, in which such men as Goode, Jordan, Evermann, Nichols, Gudger, Bigelow, Barbour, Parker, Eigermann, Townsend, and numerous others have rendered an inestimable service to humanity by their gradual pushing back of the horizon of marine life, ichthyology to-day stands at a point where a correct appraisal has been made possible of the problems remaining to be solved in order to develop for an ever-expanding race all the potential treasures of the sea.

SALT WATER GAME FISHES

It is an interesting coincidence that most of the game fishes of salt water habitat belong to those species that are favorites as food fishes. The lure of the Trout stream and Bass-abounding waters, and the fascination of pursuing the Pickerel and the Muskellunge, the Pike and the Grayling, have brought thrills to millions who have cast a line in fresh water.

But the man who originated salt-water fishing with rod and reel, where the sport really begins when the game is hooked, where hours of battle are often required to bring the valiant fighter to gaff—hours in which the crown of victory trembles in the balance between fish and fisherman—that man created a sport which is the last word as a contest of human skill and piscatorial gameness.

Angling with rod and reel for salt-water fishes is of comparatively recent origin, but when done "according to Hoyle" it makes the battle between fish and man a fight that gives the fish an even chance, and can be won by the fisherman only through the exercise of his last reserve of skill.

The Tuna, the Black Sea Bass, the Weakfish, the Striped Bass, the Bluefish, the Tautog, and the Sheepshead all offer sport with as many thrills as Tarpon fishing affords, when each is caught with the tackle prescribed by sportsmen's associations for battle with the respective species.

"THE LION, TIGER, AND ELEPHANT TRINITY"

One authority has called the Tarpon, Tuna, and Black Sea Bass the lion, tiger, and elephant trinity of the angling world. Yet the game is bringing them to gaff with seven-foot rods, weighing not more than 25 ounces, although there may be from 100 to even 400 pounds of game and fighting fish at the other end of the line!

It is a battle royal when one of these resourceful and unrelenting denizens of the deep is well hooked by a successful strike, and reel wars against fin—a battle that the novice is almost certain to lose, and that even the veteran of many victories cannot count as won until the gaff has done its work.

The Tuna is an inhabitant of many seas. In North Atlantic waters it is known as the Horse Mackerel, in the North Sea as the Tunny, in the Mediterranean sometimes as the Great Albacore, and in California and southern Florida waters as the Tuna.

In the vicinity of Santa Catalina, California, Tuna angling has reached its high-water mark as a sport. The angling ground is a narrow, four-mile stretch of coast in the lee of the island mountains, where there are several small open bays, generally smooth, with wind blowing only a part of the day. The vicinity of Miami Beach, Florida, is also a favorite hunting ground.

THE TACKLE FOR TUNA

Such a fine fighter needs special tackle, if it is to be taken in true sportsman's style, and if that tackle isn't the best that ingenuity can devise and money can buy, it is safe to wager long odds that the prize will not be landed.

Once a successful strike has been made, the game is to bring the quarry to the boatside with rod and reel. A little too rigid holding of the rod, a momentary failure to keep the line taut, a little lapse of skill in the manipulation of the reel—in short, any one of a dozen kinds of mishaps and the battle is lost or begun again.

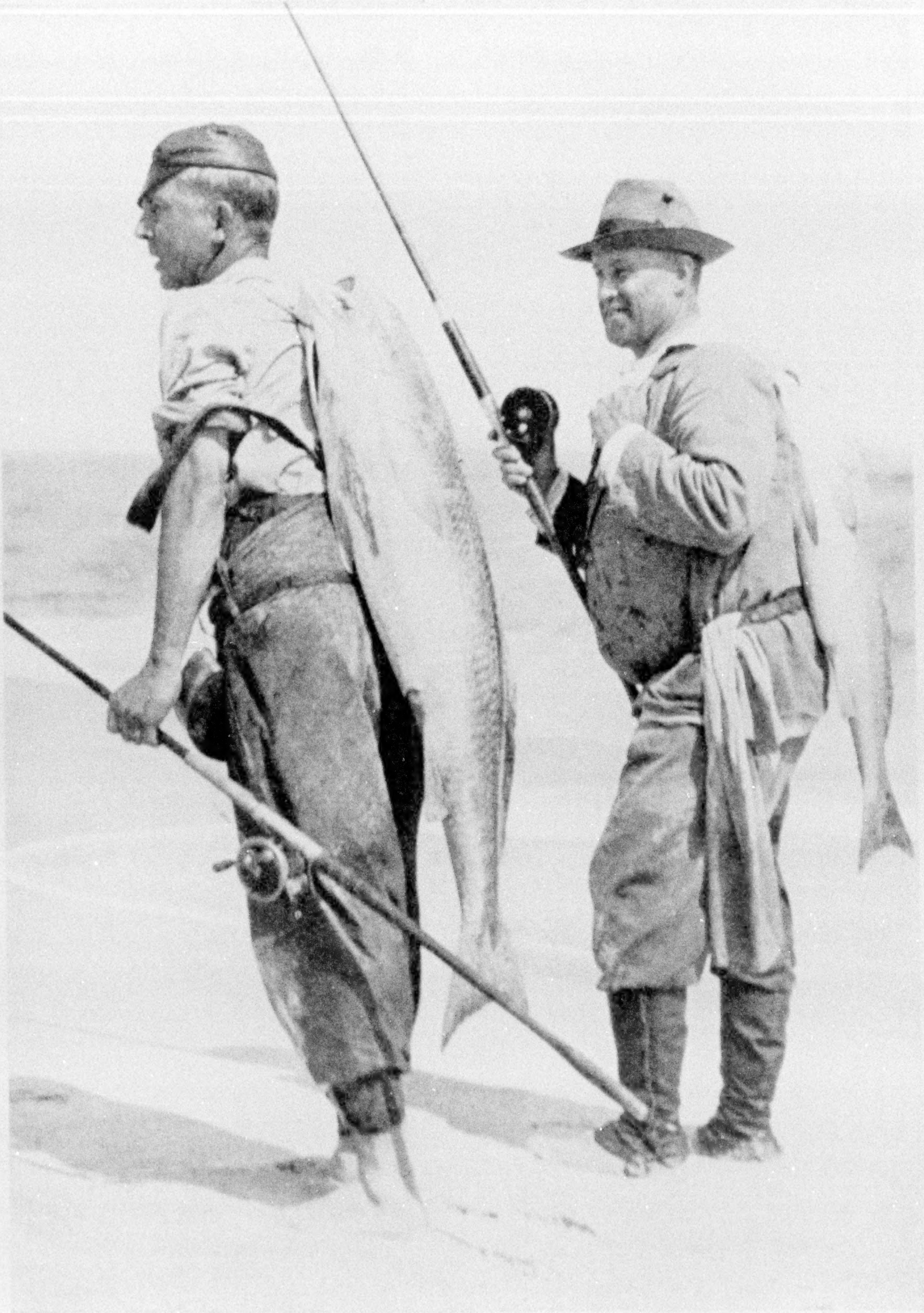
Special boats are required for Tuna fishing as a sport. They are broad-beamed launches, built for two fishermen and the boatman, who serves as engineer, helmsman, and gaffer. Usually each boat is equipped with a three- or five-horse-power gasoline engine.

Then the fun really begins in earnest. Leaping into the air, running hither and yon, diving, darting, and fighting every inch of the way, the great fish gives battle. Often it lasts for hours; sometimes the fight ranges over a ten-mile sector.

There are 300 feet of No. 24 Cuttyhunk line to be fought over by man and fish. Now reeling it in to bring the fighting quarry toward the gaff, now playing it out to prevent a jerk that might part it, the battle rages until triumph comes to the sportsman or victory to the fish.

In California Flying Fish is the bait on which the Tuna strikes best. The latter come in large schools between the middle of May and the last of June, and at once divide into companies of from fifty to a hundred.

For awhile they play around on the surface; then suddenly there is a great splash and the fretted waters turn into a



Photograph by H. Armstrong Roberts

TWO SALT-WATER GAME FISHERMEN WITH THEIR PRIZES OF A DAY

These two Channel Bass, one weighing 47 pounds and the other 23, show the possibilities of sport with rod and reel in sea fishing. He who gets a game fish weighing from 40 to 200 pounds on a hook becomes a party to a battle royal in which man and fish may struggle for hours, with victory trembling in the balance all the while and the issue undecided until the very last moment (see text, page 601).

Photograph by H. Armstrong Roberts

LANDING A SIX-POUND WEAKFISH, OR SQUETEAGUE, IN BARNEGAT BAY, NEW JERSEY

The Weakfish did not get its name from any lack of gameness, but rather from the softness of its mouth parts. At the end of a line and rod of sportsmanlike proportions it can give the fisherman who hooks it a battle that calls for all the resources of skill to bring it to the landing net (see text, page 601).

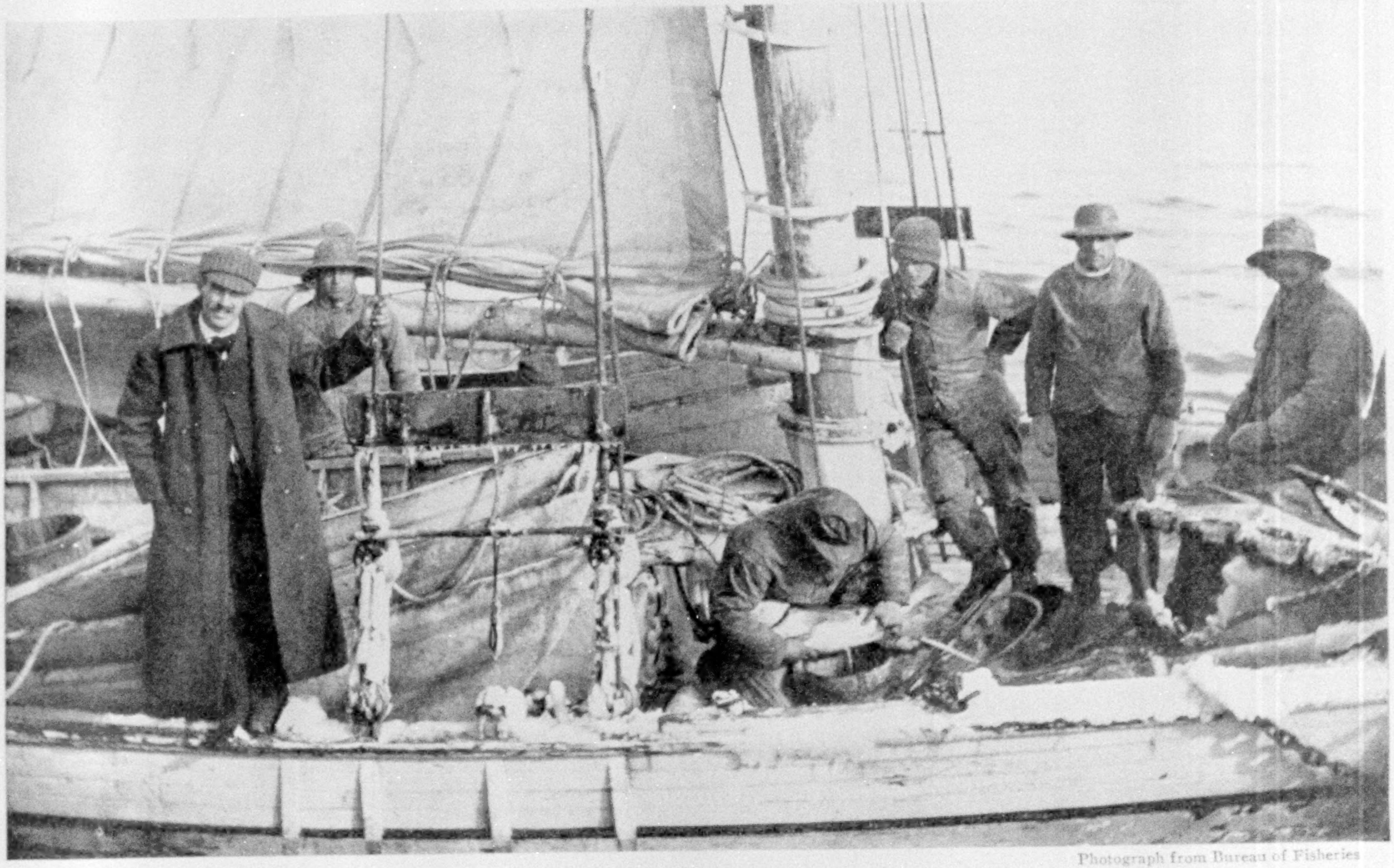
boiling spray; the Tunas have sighted a school of Flying Fish, which skim along in frenzy and wild confusion from their natural enemies. That is the signal for which the fishermen have been waiting, and the sport is on.

TARPON THE EASTERN RIVAL OF THE TUNA

The Tarpon is not classed as a food fish, but it is to Atlantic waters all that the Tuna is to Pacific, the acme in sea sport fishing.

The credit for originating the sport of Tarpon fishing belongs to William S. Jones, of Philadelphia. Back in the late eighties he was fishing in the Indian River Inlet, in Florida, and chanced to hook a 130-pound Tarpon, which was six feet long. For two hours he battled with his quarry and finally brought it to gaff.

Wherever fishermen forgathered in that day, the story of Jones' triumph was told, and soon Jupiter Inlet became the mecca of the Nation's rod and reel champions. To-day Tarpon fishing is an established sport at many resorts in southern Florida, both on the Gulf side and in the Atlantic, and clubs strictly regulate the character



Photograph from Bureau of Fisheries

FISH HATCHERY EXPERTS REMOVING EGGS AND MILT FROM FISHES FOR ARTIFICIAL PROPAGATION PURPOSES of tackle to be used to a point where only skill can win.

The vast schools of Mullet upon which the Tarpon preys form the magnet that draws him to the various feeding grounds in Gulf and Florida waters.

Ordinarily one does not think of the Weakfish, or Squeteague, as offering much in the way of sport, but when angled for with appropriate tackle, it can give the fisherman thrills that leave nothing to be desired.

Its abundance and willingness to bite make it popular with anglers who want action. It is a handsome member of the finny tribe. The Cape Cod fishermen call it the "drummer" because of the peculiar noise it makes when traveling in schools. It gets its name "Weakfish" not because of its lack either of gameness or stamina, but because the bony processes of its mouth are soft and tender.

There is never a doubt when a Weakfish bites. It simply swoops down on the bait and is off with it like a flash. Its soft mouth-parts call for skill in bringing it in. A sudden jerk will tear out the hook, hence the line must always be taut, and the fish must be led in rather than dragged. Rods weighing from ten to fifteen ounces, made of greenheart or bamboo, are prescribed for Weakfish angling, and a fine linen line 300 feet long, with a multiplying reel, is employed.

THE STRIPED BASS AS A FIGHTER

All anglers agree that the fisherman who hooks a Striped Bass with proper tackle has a run for his money. Once hooked, this flashing fighter does not spend its time leaping out of the water, trying to shake the line loose, as does the Salmon.

Rather it makes a first fierce plunge and brings every ounce of its muscular fiber to bear against the line. If this is strong enough to hold it in leash, it seeks to free itself by finesse and strategy. Now it tries to chafe the line over the sharp edge of the rocks to which it runs; failing in that, the fighter will attempt to foul the line in seaweed and kelp.

But if it be of good size and the rod of about 18-ounce weight, with a 12- or 18-thread Cuttyhunk line and a quadruple multiplier reel, it will give the disciple of the Izaak Walton League who hooks it a lively and artistic tussle before throwing up the sponge.

Loving brackish water, the Striped Bass brings the sport of philosophers a considerable distance inland. Roanoke and Potomac rivers, the Raritan and the Passaic, and numerous others afford excellent fishing grounds for Striped Bass.

It is a temperamental fish, shy to a degree at times, now taking one bait and now responding to another. Small Eels, Shrimps, Crabs, and blood worms are to its particular liking.

THE GAME AND GAUDY BLUEFISH

Usually we think of the Bluefish as one of the dependables of the bill of fare; but it has some exciting moments to offer the angler who prefers the rod and reel of the sportsman to the hand line of the pot fisherman.

With a spanking breeze and a moderate sea, the man who hooks a Bluefish earns his dinner. It makes a smashing fight, and the fisherman who lacks the skill of giving proper tautness to his line is likely to find it broken by a sudden rush or shaken loose if allowed to slack.

Though the leader may be of wire, the fish will attempt to swim ahead and bite the line in two with its sharp teeth.

One angler has described the hooked Bluefish as a wild tiger, with all its strength and courage and deviltry—now running deep, now rushing from side to side, but always pulling and jerking with its entire strength in its mad battle for freedom—a foeman worthy of any one's steel.

Lobster tail, shedder Crabs, live Killies or small Herrings are tempting tidbits to the voracious Bluefish, which has been called the glutton of the deep.

It is related that Bluefishes are utterly wanton in their gluttony and will prey on a school of lesser fish until their stomachs are so full that they disgorge the harvest and begin all over again.

The Bluefish, like the Striped Bass, brings the joy of salt-water game fishing into many of the Atlantic coast rivers, notably the Hudson, the lower Potomac, and Hampton Roads.

Some of the deep-water food fishes offer good sport for the fishermen who go down to the sea in boats to cast their lines. One of these is the Sea Bass, a

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"THE BREAKER," AN ICE-COVERED TRAWLER JUST IN FROM A TRIP TO THE FISHING GROUNDS, AT THE FISH PIER, BOSTON

rather sluggish citizen of the sea, but withal a ready biter and interesting game for those people who like to go out on an excursion steamer that drops anchor on the banks off Sandy Hook, for instance.

Sometimes the Black Sea Bass breaks water like its river cousin, and makes vicious leaps and contortions in its efforts to free itself; but its jaws are leathery and once well hooked it seldom gets away. An eight-ounce rod is the rule for sportsmen angling for the Sea Bass.

All hands pay tribute to the Kingfish as perhaps the gamest for its size of all the bottom-feeding denizens of salt water. Famous alike for its qualities, its splendid color, its graceful form, and its fine flavor, it was christened the Kingfish by the *bons vivants* of Colonial days, when New York was yet New Amsterdam. It takes bait readily, Clams, bits of fish, shedder Crabs, sandworms, and Shrimps being to its liking. Its tactics when hooked are largely those of the Small-mouthed Bass. In surf fishing the best time to catch the Kingfish is the first of the flood tide.

The treasures of the sea are many, but none is more certain to yield delight to the true sportsman than the game fishes that disport in its waters. The commercial fisherman, with his seines and hand lines, is perennially harvesting boatloads of sea fish for a large consuming public; but the real joy of the ocean is reserved for those with rods and lines properly designed to put the fisherman and his prize on even terms, where human skill and piscatorial generalship can each have its innings and the issue remains in doubt to the climax.

POLLOCK (Pollachius virens)

(For illustration see Color Plate I)

The Pollock, also known as the Green Cod, or Coalfish, has a range that reaches across the Atlantic and as far south as Cape Henry, although it is not taken in commercial quantities south of New Jersey. In size it attains a weight of 35 pounds and a length of 4 feet. It is a voracious eater and very destructive of young Cod. A ready biter, many sportsmen regard it as a fine game fish for rod and reel.

Though a bottom-feeder, the Pollock frequents the surface and intermediate depths. It congregates in large schools, roams from place to place, and preys on all kinds of young fish. Professor Sars tells of witnessing an attack by a Pollock school on a school of small Cod. The latter were completely surrounded and driven into a compact mass. On the edge of the mass the Pollocks bored in, eating their voracious way, while from above the screeching sea gulls plunged down to share the feast. In dire panic the young Cods darted this way and that and broke through the line as best they could.

The Pollock appear about Cape Cod early in May, passing Race Point so close inshore that they are often caught with seines on the "tide rips." A favorite spawning ground is off Cape Ann, where they stay from early May to late January, and by October get so numerous at times that they annoy the Cod fishermen by taking the bait before it has time to sink to Cod depth.

The liver of the Pollock is particularly rich in oil, the medicinal quality of which is not inferior to cod-liver oil. The Pollock, like the Haddock, is rarely salted.

CODFISH (Gadus callarias)

(For illustration see Color Plate I)

The Codfish belongs to a family which comprises many species, including some of our most valuable marine fishes. The principal species are the Cod, Haddock, Pollock, Hake, and Cusk.

Until recent years the annual value of the Cod has exceeded that of its close relatives, but during the past decade the Haddock fisheries have on several occasions assumed the first rank. The Cod owes its value as a food fish to its flavor, size, comparatively few bones, year-round abundance, and adaptability to dry-salting. Fishes rich in oil cannot be successfully dry-salted, and for this reason such species as the Salmon, Bluefish, and Mackerel, if salted at all, must be put into brine.

The Cod is a cold-water fish and its movements are largely governed by changes in the water temperature. However, the temperature in many parts of the North Atlantic is so low throughout the year that the Codfish may be caught in equal abundance the year round. It is generally taken at depths of from 8 to 40 fathoms, but is known to inhabit much deeper water. It is found on our Atlantic coast from Cape Hatteras northward and is also an important species on the European coast. It is taken in commercial quantities in all our Atlantic States from New Jersey northward. Along the New Jersey coast it is found from late November until early May, but off the New England coast and the offshore "banks" it is caught throughout the year.

The Cod is taken with otter trawls, trawl lines, hand lines, and gill nets. The larger vessels employ the otter trawls and are known as "trawlers." Hand lines and trawl lines are the most popular methods of fishing, as their use requires only a small boat and crew. The boats range in size from the small motor and sail type to the large steam trawlers. Nearly all boats now carry engines, and thus are better equipped to encounter the frequent fogs and the violent storms which appear almost without warning, and which were the bane of fishermen of former days.

The Cod is an omnivorous feeder, eating almost anything it happens upon. Its chief food appears to be Mollusks, crustaceans, worms, and fish, but articles such as jewelry, glass, stones, leather, etc., have been found in its stomach. Its omnivorous habit is responsible for the finding in its stomach of rare fishes and shells that otherwise might not have been known to exist.

Spawning takes place along the New England coast from October to June. The eggs are about one-nineteenth of an inch in diameter and since they float at the surface, many are cast ashore, eaten by birds, or otherwise destroyed. To offset this great destruction, Nature has rendered the Cod very prolific and a good-sized fish may contain several million eggs.

The largest Cod recorded was more than 6 feet long and weighed 211½ pounds, but fish weighing more than 75 pounds are comparatively rare. The usual size of those taken on the banks ranges between 10 and 35 pounds. The Cod is not a game fish, but when hooked by an angler is a welcome addition to his catch.

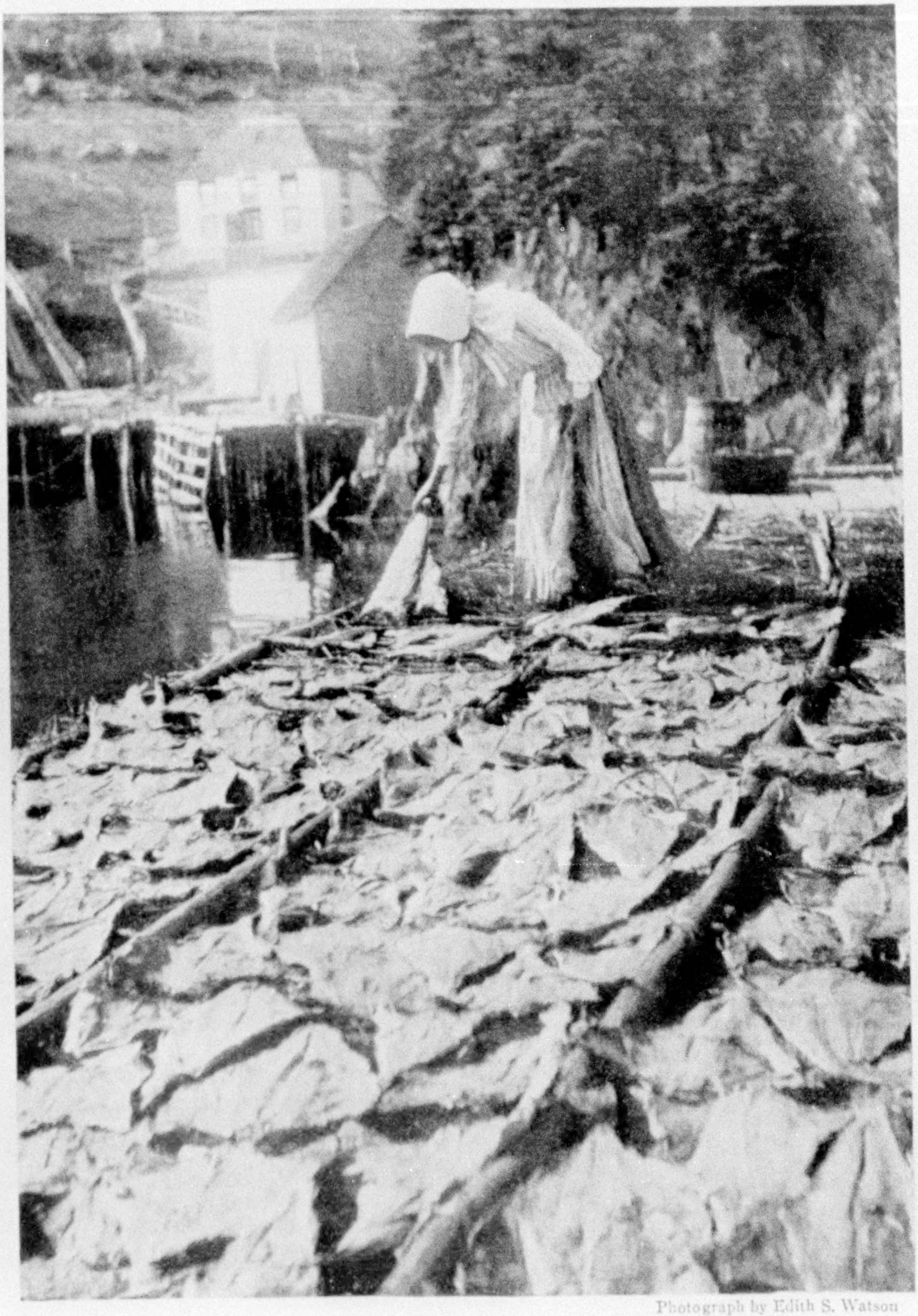
It is said that the Cod fisheries constituted one of the inducements that led England to establish colonies in America. Their early importance was so great that the Cod won a place on the seal of the Colony of Massachusetts, and in the Massachusetts State House it is honored with an image. The Cod has been portrayed on Nova Scotian bank notes with the legend "Success to the Fisheries," and on the early postage stamps of Newfoundland, where the courts have held that whenever the word "fish" is unqualified it must be taken to mean Codfish.

HADDOCK (Melanogrammus æglifinus)

(For illustration see Color Plate I)

The Haddock is close to the Cod both in appearance and in its quality as food. It may be known at sight by the characteristic black lateral line that reaches from gill to tail. The "Finnan Haddie" of commerce, which is said to take its name from Findon or Findhorn, both towns in Scotland, is smoked Haddock. Unlike the Cod, the Haddock is seldom salted.

On the American coast the Haddock rarely



Photograph by Edith S. Watson

SPREADING CODFISH FOR DRYING

The banks on which the American Cod fishery is located cover an area of approximately 60,000 square miles, stretching in a southeasterly direction from the Newfoundland coast toward the center of the Atlantic Ocean. The depths in which the fishing is carried on range from 60 feet on the crest of the banks to 800 feet on their lower slopes. When a vessel goes out to the fishing grounds it usually carries some 400 hogsheads of salt and from 7 to 12 tons of bait, mostly frozen Squid and Herring.

Photograph by Franklin L. Fisher

LANDING MACKEREL AT NEW BEDFORD, MASSACHUSETTS

Thanks to its habits of moving in schools, the Mackerel falls easy prey to all the larger predaceous sea creatures, particularly Sharks, Dogfish, Tuna, Bonito, and Bluefish. The mystery of its migrations still awaits solution.

is encountered north of the Straits of Belle Isle or south of Hatteras. On European shores its habitat extends from Icelandic waters to those of France and entirely surrounds the British Isles.

More gregarious than the Cod, the Haddock swims in large, compact schools in its migrations from place to place. It is a bottom-feeder and has marine invertebrates for its principal diet, Mollusks seeming to be favored above everything else. The spawning season of the Haddock is from April to June. The average size of those caught is from 2 to 4 pounds, with 17 pounds as about the maximum.

In recent years the catch of Haddock has been so large as to make it a rival of the Cod, which it has occasionally outranked in the annual value of the catch.

WINTER FLOUNDER (Pseudopleuronectes americanus), and SUMMER FLOUNDER (Paralichthys dentatus)

(For illustration see Color Plate II)

The Flounder family includes the Halibuts, the Flounders, and the Turbots. The Winter Flounder (*Pseudopleuronectes americanus*) belongs to the Flounder tribe and is an important food fish on the New England coast. Next to the Halibut, it is the most widely caught Flatfish in Atlantic waters, and ranges from Labrador to Hatteras, being especially abundant on the Massachusetts and Connecticut shores. It is not a large species, seldom attaining to more than 20 inches in length and 5 pounds in weight. A large female produces as many as a million eggs, the spawning season being from February to April. This species feeds on shellfish, young Crabs, and similar foods. It is a favorite with many anglers, being one of the few shore fish that can be caught during late winter. In the vicinity of New York hundreds of anglers may be seen fishing for Flounders on favorable days during March and April.

The Summer Flounder (*Paralichthys dentatus*) or Plaice, also highly regarded as a food fish, is in some quarters known as the Fluke. It is distinguished from the Winter Flounder by having a large mouth, whereas the other has a very small one. It averages in size from two to eight pounds and compares with the Turbot and the Brill of the English coast. The largest one recorded weighed 19½ pounds.

The Summer Flounders, like the Winter species, habitually live on the bottom, where their shape and color camouflage them and give them opportunity to catch their prey. They are found mostly in bays, on sandy, muddy, or rocky bottoms. Feeding on small fishes, Crabs, Shrimps, and Squids, they frequently come to the surface in pursuit of their prey.

The migration of the eye in Flounders is one of the strange provisions of Nature for the protection of the Flatfish tribe. In early youth the Flounders swim about normally, with their eyes symmetrically placed; but as the

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WEIGHING AND BOXING SHAD FOR MARKET

The Shad is one of our most important fishes commercially, about fifty million pounds being sold annually. It has long been decreasing in numbers, due to overfishing and to the ever-increasing pollution of the rivers in which it spawns.

fishes develop they lie flat in the sand, some species on one side and some on the other, and the right eye migrates over to the left side, or vice versa, so that they ultimately have both eyes on one side of their heads.

HALIBUT (Hippoglossus hippoglossus)

(For illustration see Color Plate III)

The Halibut is the largest fish of the Flounder family and one of the most widespread in its range. It claims all seas for its habitat, in regions north of Havre, New York, and San Francisco.

A strange fact concerning this and other cold-water species is that they have eyes and color on the right side, while species inhabiting warm water have eyes and color on the left side.

The Halibut usually frequents offshore banks and exists in great numbers in many localities, but is sought after with such eagerness that it is gradually decreasing in numbers. It grows to a large size and fish weighing 200 or 300 pounds are often taken. The record weight was established when in June, 1917, the *Eva Avina*, fishing 50 miles off Thatcher Island, Massachusetts, caught a Halibut 9 feet 2 inches long and 4 feet 2 inches broad, weighing 625 pounds dressed.

The seaward movement of the Halibut has been noted by American fishermen. When the taking of Halibut first began, it was most abundant on Georges Banks. Later it gradually disappeared from those banks and went farther out to sea. It is now found mostly in the deep gullies between the offshore banks and on the outer edges of those banks, in water 100 to 350 fathoms deep.

A voracious eater, the Halibut feeds upon the Skate, Cod, Haddock, Menhaden, Mackerel,

Photograph by Press Illustrating Service

CLEANING FISH IN QUAINT ST. JOHN'S, NEWFOUNDLAND

Many men spend practically their entire lives as fish cleaners. Even in so humble a trade rivalries crop out, and there are a number of claimants for the international championship in fish dressing.

Herring, Lobster, Cusk, etc. Crabs and Mollusks are also to its liking. Instances are recorded where it has attacked Codfish and stunned them by the flip of its tail. One was so busy putting a big Cod *hors de combat* that it allowed a dory to steal up and capture it before it had become aware of its peril.

The female Halibut becomes heavy with roe in July and August, and instances have occurred where such a large quantity was taken from one of them that a good-sized man could scarcely carry it.

COMMON STURGEON (Acipenser sturio)

(For illustration see Color Plate IV)

The Common Sturgeon has a maximum length of about 10 feet and sometimes reaches a weight of 500 pounds. Its range is from the Carolinas to Maine, but the region of its greatest abundance is the Delaware River. It is a migratory fish, spends most of its time near the shore, and then runs to brackish or fresh water to spawn.

Considerable change in the Sturgeon's appearance takes place as it grows older. The young have more slender and protuberant snouts than their elders. The sexes also differ, in that the male has an oblong head, with a wide, blunt snout, while the female's head is triangular, rapidly narrowing from the back to the snout.

A bottom-feeder, the presence of Mussel and other shell fragments in its stomach, as well as of mud containing the remains of small crustaceans, tells of its habit of scooping its dinner from the floor of the sea. The barbels and lips are sensitive in the detection of food, but the snout is used to root up the soft bottom of shoal places in search of something to eat.

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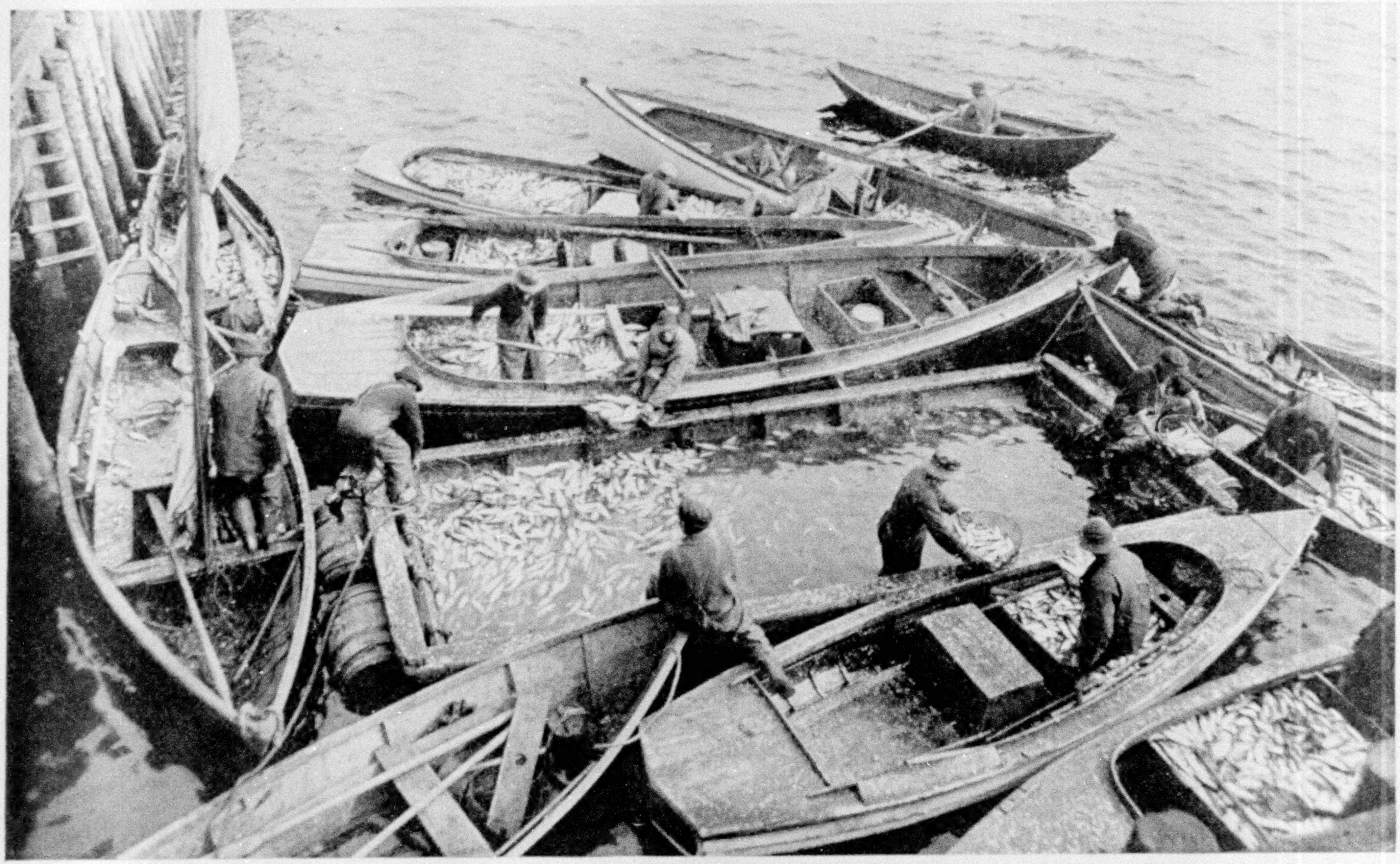


FISHERMEN UNLOADING THEIR HERRING AT A LOCKEPORT CANNERY: NOVA SCOTIA

The Herring family is large and prosperous. It includes such diverse members as the Shad, the Pilchard, the Anchovy, the Sprat, and the Whitebait. All branches of the family have small mouths and either have no teeth at all or very small ones. They are therefore, for the most part, obliged to find sustenance in the myriad of minute animals diffused through the waters of the ocean or lurking among the weeds at the bottom.

Goode assures us that this fish is prone to jump out of the water at an angle and may project its body for some distance. It is so active that it sometimes leaps into small boats. One is reported to have leaped high enough above the water to jump through one of the "dead-lights," near the water's edge, of the hull of a passing side-wheel steamer, and thus to have made itself prisoner.

The spawning season is somewhat regulated by the temperature of the water on the spawning grounds. May is the usual month in the Delaware, and the latter half predominantly so. The spawning fishes, known as "runners," are usually most abundant after the middle of the schooling period. They seek a hard bottom in which to deposit their eggs. The spent females are of little value for the time being, but later they become sleek and fat, and as "cowfishes" their flesh is in prime condition.

The eggs of the Sturgeon are used in making caviar. They are not taken when the female is ready to spawn, but at an earlier period, when the roe is still "hard." The quantity taken varies, of course, with the size and quality of the female, ranging from 5 to 15 gallons in bulk and from 800,000 to 2,400,000 in number.

In the making of caviar the eggs are removed from the fish and gently rubbed over a fine screen, by which they are separated from their enveloping membrane. Under the screen the released eggs fall into a trough, through which they pass into tubs. In these tubs salt is carefully stirred with the eggs, and it draws their watery constituents from them and forms a copious brine. Later the eggs are poured into fine-meshed sieves, where they are allowed to drain until dry. They are then put into casks or cans and are ready to go into commerce.

Overfishing has done vast harm to the Sturgeon supply. In the early decades of American history it was not much in favor, though New Yorkers ate some of it as "Albany beef"; but in later decades it became a popular market fish, and along Delaware Bay were hundreds of fishermen who earned their living catching Sturgeon and making caviar. Women and children spent their long winter evenings, making Sturgeon nets. In all the bay-side towns there were Sturgeon boats awaiting the coming of the fish.

In those days the Sturgeons were plentiful, and caviar sold for from $9 to $12 a cask, which contained 135 pounds, and the output ran up into the thousands of casks. But overfishing and heedlessness of consequences sealed the doom of the fishery. Caviar went up to $120 a cask, even as far back as 1902, and although hundreds of fishermen fished every day for eight weeks, the best their combined efforts could produce was 68 casks. To-day Sturgeons are rare prizes, worth several hundred dollars each.

SQUIRREL HAKE (Urophycis chuss)

(For illustration see Color Plate V)

The Squirrel Hake and its close relative, the White Hake, *Urophycis tenuis*, belong to the Codfish family and are found on the Atlantic coast from Labrador to Hatteras. They are both ground fishes, staying close to the bottom. They are said to bite best on moonlight nights. The Hake fisheries rank about sixth in the number of tons taken in New England waters annually. They are used extensively in making boneless Cod and for corning. Their air bladders find wide use in the manufacture of isinglass and glue.

The Squirrel and White Hakes resemble each other so closely that even to the trained eye of the zoölogist the difference is not marked. The most tangible distinction is in the number and size of the scales. These are smaller, and therefore more numerous, in the White Hake. In the latter there are about 135 or 140 oblique rows of scales from the branchial opening to the caudal fin, as compared with about 100 in the Squirrel Hake.

These Hakes are not to be confused with another group of fishes sometimes called Hakes, but more commonly known as the Whitings. The representative species of the latter group is *Merluccius bilinearis*, sometimes called the Silver Hake.

CUSK (Brosmius brosme)

(For illustration see Color Plate V)

The Cusk is a member of the Codfish family, inhabiting rocky ledges in deep water in the North Atlantic above Cape Cod. It reaches the coast of Greenland and swings around the North Atlantic basin to Iceland, Norway, and Denmark.

This fish disappears from a given haunt after prolonged fishing and moves on to some other ledge. After a lapse of years it may return to the deserted ledge again.

The food of the Cusk consists of Mollusks and small crustaceans. It is an excellent food fish and is widely caught in the present New England fisheries.

WHITING (Merluccius bilinearis)

(For illustration see Color Plate V)

Sometimes known as the Silver Hake, this species is now coming to preëmpt the common name Whiting—a term which in former days was applied in divers localities to various species of fishes belonging to as many different families.

It commonly inhabits the middle depths of the ocean or the outer edge of the continental slope, but finds its feeding ground at or near the surface, where it preys upon schools of Herring and other small fish. Usually, when attacking its victims, it congregates in schools of considerable numbers. Its teeth are sharp, and it possesses a large and powerful mouth and a form muscular and lithe, which adapts it to rapid locomotion; for it, like the Pollock, is essentially a fish of prey. Its average length is about a foot.

Prior to 1880 the breeding habits of the Whiting were a mystery. An exploration of the sea bottom off Newport, at a depth of from 150 to 300 fathoms, revealed immense numbers of young fish from one-half an inch to three

Photograph from H. L. Rust, Jr.

A "GIANT" LOBSTER THAT LOST ITS LUCK

Big fellows like the one here shown are probably not giants of their species, but merely those to whom fate was so kind as to allow them to grow to their full maturity. It may have escaped the perils of half a century before the luckless hour when it became enmeshed in some fisherman's gear (see text, page 581).

inches long, and with them were many adults from one foot to one and a half feet long, apparently in the midst of the spawning season.

The New England Whiting is closely related to the European Hake, *Merluccius merluccius,* and to the California Hake, *Merluccius productus.* It appears that the spawning time of the European Hake is from January to April. During this period both species seem to lose the great voracity which characterizes them at other times, and are mostly taken at that season in trawls rather than with lines.

MACKEREL (Scomber scombrus)

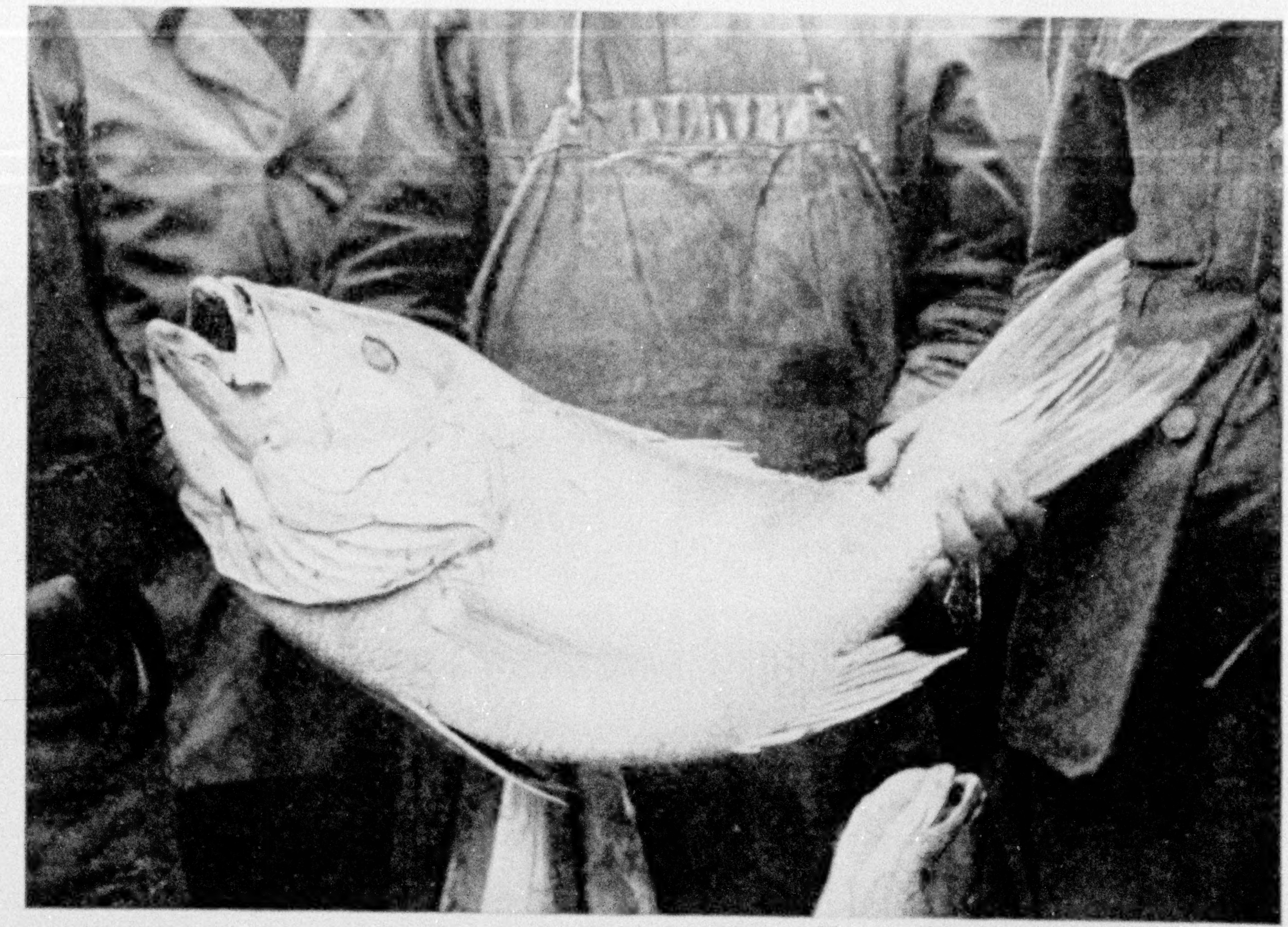
(*For illustration see Color Plate VI*)

The Mackerel is a member of the Mackerel family, which includes the Tuna, the Bonito, the Kingfish, and the Wahoo, or Peto. It ranges as far south as Hatteras and as far north as the Straits of Belle Isle, and, being a shore-loving fish, does not wander far to sea. It first appears on the Hatteras coast in the early spring, and gradually migrates north, its migration seeming to be regulated by the fluctuation of water temperature. Schools 20 miles long and half a mile wide have been sighted. In the seventies an international dispute arose regarding the migration of these fishes. Our Government took the position that the Mackerel do not come from deep water offshore to warmer water inshore, but that they are first found in the spring off Cape Henry and can be followed day by day as they move, in countless hordes, northward to Maine and Nova Scotia. Canada held that they came inshore from deep water offshore. The American viewpoint has been proven correct.

The spawning season for the Mackerel extends from May to July. The spawning grounds are in rather deep water off the coast, stretching between Long Island Sound and the Gulf of St. Lawrence. Prior to spawning the fish are lean and their flesh is of poor texture, but after that task is over they get fine and fat, being regarded as among the best fishes in Atlantic waters.

The food of the Mackerel consists of small crustaceans, Lobster spawn, and the "small fry of the seas." One tiny crustacean favorite is the red, spiderlike creature known as "the Boone Island bedbug," and old fishermen declare that wherever it is found they can afford to wait, for it is bound to bring the Mackerel to its feeding ground.

Many enemies prey on the Mackerel. The gannets often eat so many that they are unable to rise from the sea to avoid a passing ship until they have disgorged several good-sized fish. Porpoises, whales, Sharks, and Dogfish also are dangerous enemies. Indeed, the last named are sometimes so hungry that they will bite the twine of the fishermen's nets to get inside and prey upon the catch at will. They



Photograph by Underwood & Underwood

A RED SNAPPER EXHIBITED ON "NATIONAL FISH DAY" AT FULTON MARKET, NEW YORK

Many market fishermen, who supply the demands of northern cities from waters offshore during the summer, move southward from New England to Miami Beach, Florida, during the winter season in order that their customers may have an uninterrupted supply of Kingfish, Mackerel, Snappers, and the varieties of fish highly prized for the family table.

have also been known to follow the catch to the very sides of the ships and swim around the scuppers and drink the blood flowing from the dressing operations aboard the boat.

The Squids also are enemies. They suddenly dart back among the Mackerel with arrowlike speed, and, quickly turning to one side, seize a victim, sink their sharp beaks into the nape of the neck, and kill it almost instantly by severing the spinal cord. Sometimes they fail. When they do, they drop to the bottom and change their color from translucent paleness to that of sand, in order to camouflage their presence while waiting for the Mackerel to return. The latter usually stay well inshore, and are warned of the enemy's presence, for as soon as the Squid gets into too shallow water it begins to pump with great energy and to discharge its ink in large quantities. Thousands of them are stranded and perish when their eagerness for a dinner leads them into shallow water.

TUNA (Thunnus thynnus)

(*For illustration see Color Plate VII*)

Few fishes have a wider distribution than the Tuna, for it is found in all warm seas. It is pelagic in its habits and occurs as far north as Newfoundland. It is the Tuna of California and the Mediterranean, the Tunny of the British Isles, the great Albacore, or Horse Mackerel, of our Atlantic waters. It belongs to the Mackerel family, of which it is the largest representative. On the North Atlantic coast, where Tuna are caught from early summer to October, they are large and numerous. During one season a single fisherman harpooned 30 of them with an average weight of 1,000 pounds. Some weighing 1,500 pounds have been taken. They also are caught on hooks baited with Herring attached to heavy lines.

The European varieties do not attain such size, 500 pounds being considered about the upper limit of their weight. On our California coast they are still smaller.

It is on this coast that they are considered the game fish *par excellence*. Charles F. Holder once observed that, weight for weight, the Tuna has double the fighting power in it that the Tarpon possesses. He called it the tiger of the California coast, a living meteor that strikes like a whirlwind and plays like a storm.

In American Atlantic waters the Tuna is found from Nova Scotia to Cape Cod. It feeds on Herring, Menhaden, and Bluefish.

SHAD (Alosa sapidissima)

(*For illustration see Color Plate VIII*)

The Shad belongs to the Herring family and is an anadromous fish, spending the spring months in the rivers, where it spawns, and the rest of the year in deep-sea waters. On the Atlantic coast it enters all rivers between the St. Johns in Florida and the St. John in New Brunswick. Thanks to the good work in artificial propagation of the United States Bureau of Fisheries, Gulf of Mexico and Pacific coast rivers also know this delectable food fish to-day.

Formerly Shad were surprisingly abundant; but they have to be taken at spawning time, since they are not within reach of human hands at any other season; therefore they are especially liable to extinction by overfishing. Were it not for protective laws and artificial propagation, they would probably have disappeared almost entirely before now. The success of artificial propagation is shown by the fact that the Shad has been established along 2,000 miles of shore line on the Pacific where it never existed before, and that it remains, in spite of the heavy toll of overfishing, next to the Chinook Salmon, the most important river fish in America. But even with artificial propagation the catch has been diminishing at an alarming rate, having fallen off from 50,000,000 pounds in 1898 to less than one-half as much in a recent year. Overfishing, the placing of dams across many rivers, and water pollution have been responsible for the decrease.

The Shad does not appear to be a migrant from warmer to cooler waters with the advent of spring, as was formerly supposed. Rather, it seems to go out to the deep sea off the mouths of the several rivers it spawns in, and to remain there until the temperature of the river waters rises to about 60 degrees. The Shad in southern rivers has black-tipped back and tail fins, which is a mark absent in those visiting northern rivers.

The young fry, hatched out in the rivers, stay until the water falls below 60 degrees in the autumn, and then go out to sea and are not seen again until they enter the rivers to spawn, which is believed to be when they are three or four years old. The spawning Shad like to find water above 60 degrees, and go up the rivers, but the half-grown ones, preferring cooler water, stay behind. In 1882 there was a very late spring, the water not reaching 60 degrees until after spawning time. It was noted that the half-grown accompanied their elders to the spawning grounds that year.

During the spawning season the mature Shads seem to take no food at all. Their young, after hatching, feed on small crustaceans and insect larvæ until they go out to sea. The fact that the adults will rise to a skillfully placed fly at times indicates that their abstinence is due more to their impulse to hasten to spawn than to their lack of desire for food. They are a very prolific fish, yielding as high as 150,000 eggs a season. The roe of no fish is more delicious than that of the Shad, and a planked Shad garnished with roe and bacon is as much a delight in the Nation's Capital in 1923 as it was in the days of Mt. Vernon and Marshall Hall, when the Father of his Country and the Laird of Marshall Hall were friends.

The Shad sometimes attains a length of more than 2 feet and a weight of 14 pounds, but the average weight has been falling as the decades have come and gone, until now it is probably under 4 pounds.

ALEWIFE (Pomolobus pseudoharengus)

(*For illustration see Color Plate IX*)

The Alewife is a species of Herring abundant in North Atlantic waters, possessing many vernacular names. In some places it is known as the Branch Herring, in other localities as the Blear-eyed Herring, and elsewhere as the Wall-eyed Herring and the Gaspereau. It is found on our Atlantic coast from the Carolinas northward, in Lake Ontario, and in some of the small New York lakes tributary to the St. Lawrence. Like the Shad, it goes up into the rivers to spawn, preceding that fish by two to three weeks.

Those Alewives that have become landlocked in fresh water are greatly dwarfed in size. In Lake Ontario many millions die every summer.

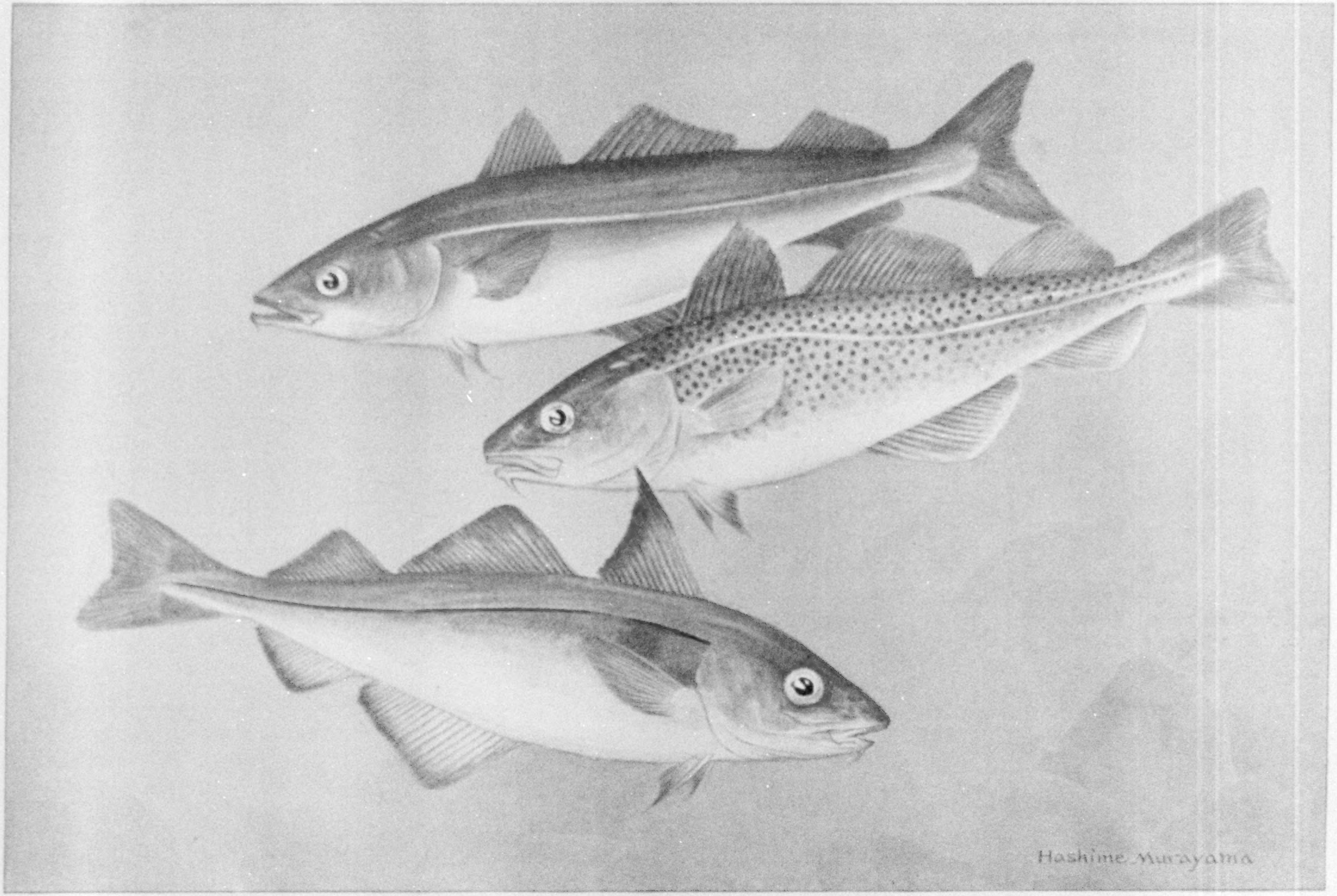
Another species, so closely related that for a long time it was not differentiated from the Branch Herring, is *Pomolobus æstivalis*, known in New England as the Summer Herring and in other localities by such names as Glut Herring, School Herring, Blueback, May Herring, Kyack, and Blackbelly.

It is found from St. Johns River, Florida, along the entire Atlantic coast of the United States and the British Maritime provinces. The great centers of abundance are Albemarle Sound and Chesapeake Bay, where it is known as the Glut Herring, this term having reference to its abundance, which frequently leads to a glutted market.

The circumstances under which the two species were differentiated form a tribute to the keen-eyedness of Potomac fishermen. The attention of the zoölogists of what was then the Fish Commission was first called to the probable existence of the two species by the persistent opinions of the fishermen of the Potomac, who recognized two forms, differing somewhat both in habits and in appearance. These two forms they called respectively the Branch Herring and the Glut Herring.

The first announcement of the discovery of the existence of two species and the definition of their respective characteristics was published in a report of the Virginia Fish Commission for 1879. Goode remarks that, although the coast fishermen of Massachusetts and Maine claim to distinguish between the Alewives and the Bluebacks, their judgment is by no means infallible, since, when he had finished sorting them out into two piles, the fishes which they distinguished under these names were not at all accurately classified.

Like the Shad, both the Branch Herring and the Glut Herring are anadromous in habits.



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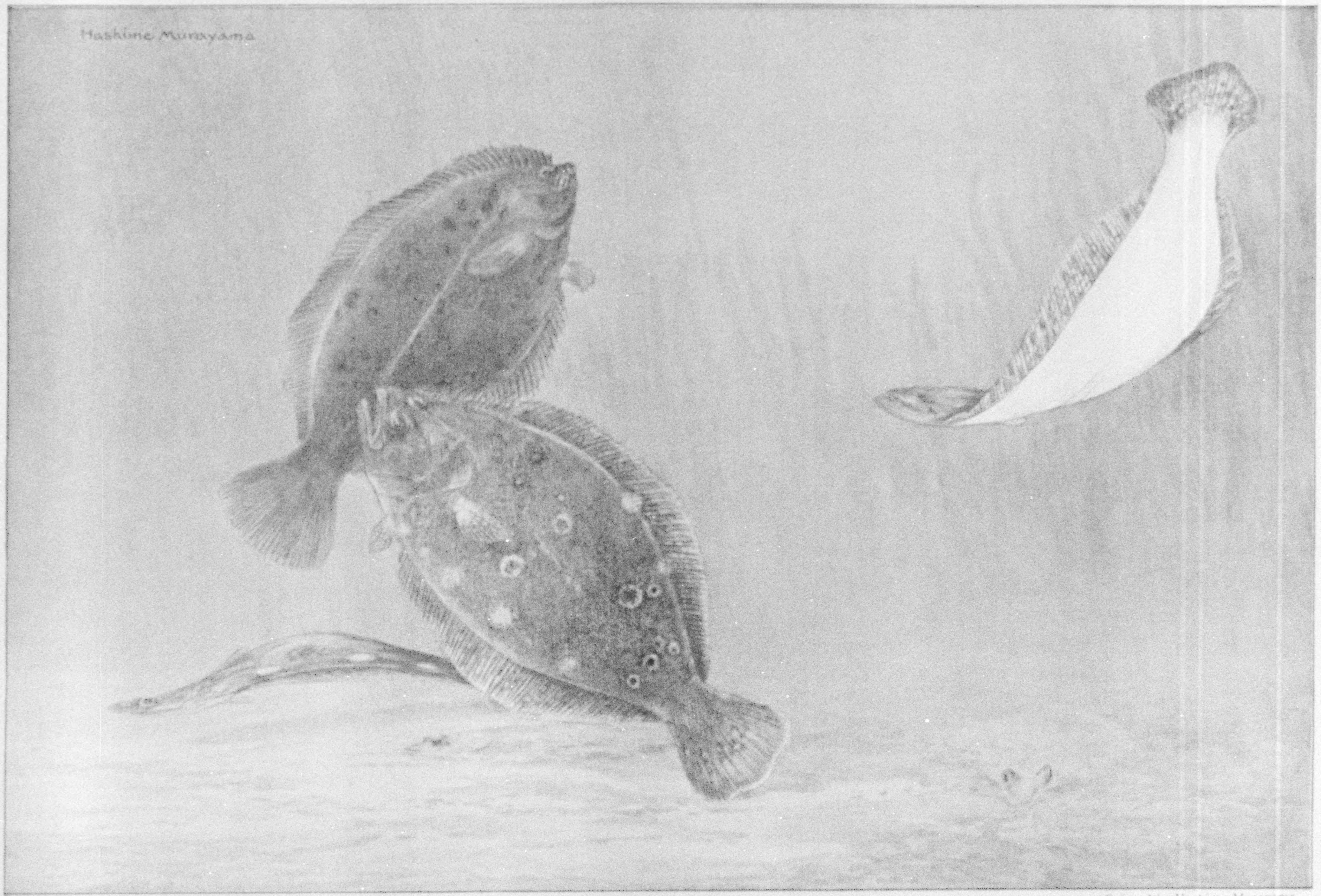
POLLOCK (*Pollachius virens*) [at top]; CODFISH (*Gadus callarias*) [center]; HADDOCK (*Melanogrammus aeglifinus*)

Ranging across the Atlantic and as far south as Cape Henry, the Pollock, also known as Green Cod, or Coalfish, attains a weight of 35 pounds and a length of four feet. The liver yields an oil not inferior medicinally to that of the Cod. The temperature of many parts of the North Atlantic is so low that Codfish may be caught the year round. The catch of Haddock in recent years has made it a rival of the Cod, which it now occasionally outranks.

XUM



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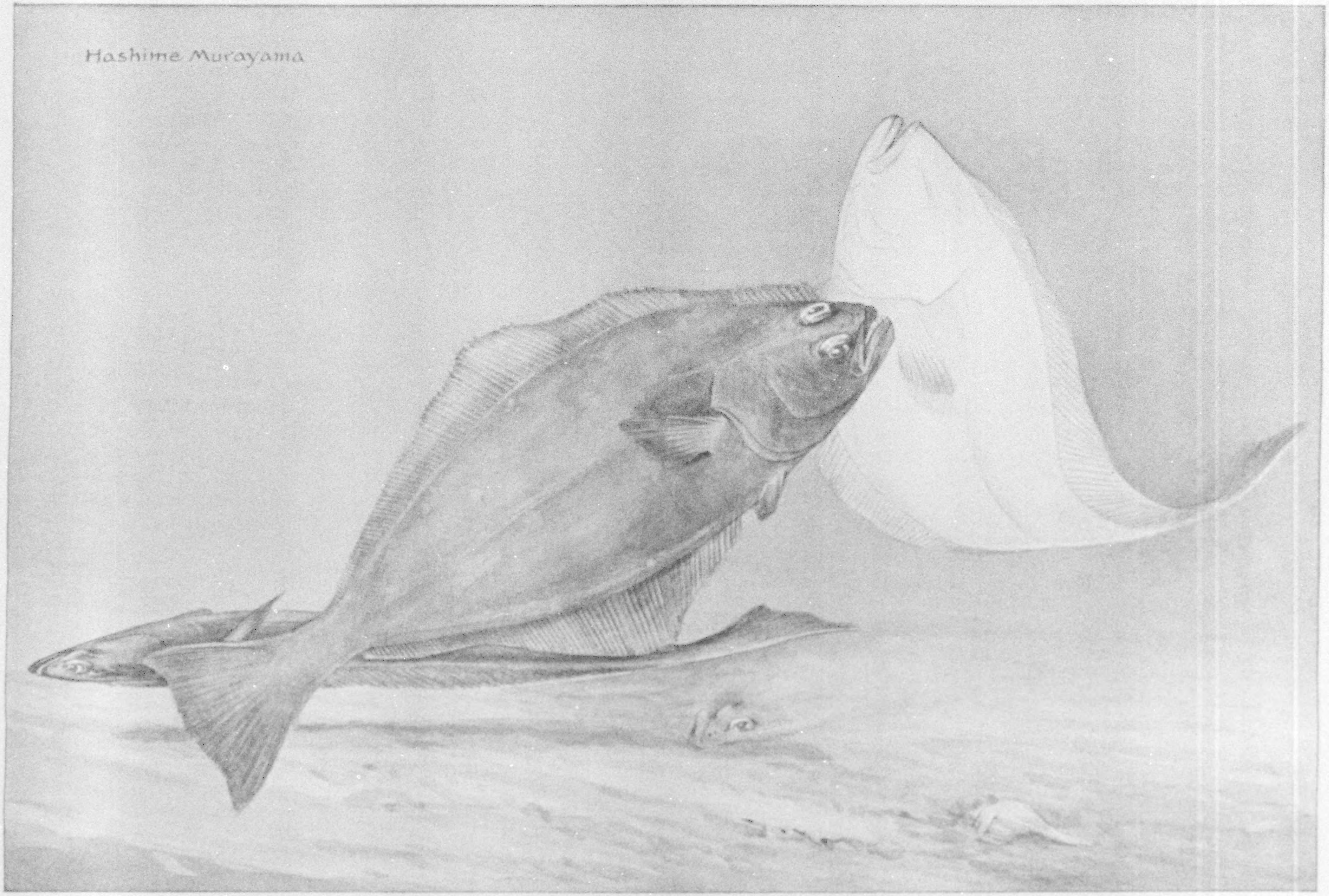
WINTER FLOUNDER (*Pseudopleuronectes americanus*) [upper left]; SUMMER FLOUNDER (*Paralichthys dentatus*) [center]

The Winter Flounder belongs to the Plaice tribe and, next to the Halibut, is the most widely caught Flatfish in Atlantic waters. It ranges from Labrador to Hatteras, being especially abundant on the shores of Massachusetts and Connecticut. The Summer Flounder, like the Winter species, habitually lives at the bottom, where its shape, color, and sand-burrowing habits effectively camouflage it. Note the one nearly buried in the sand. The migration of the Flounder's eyes is a strange phenomenon of fish life (described in text).



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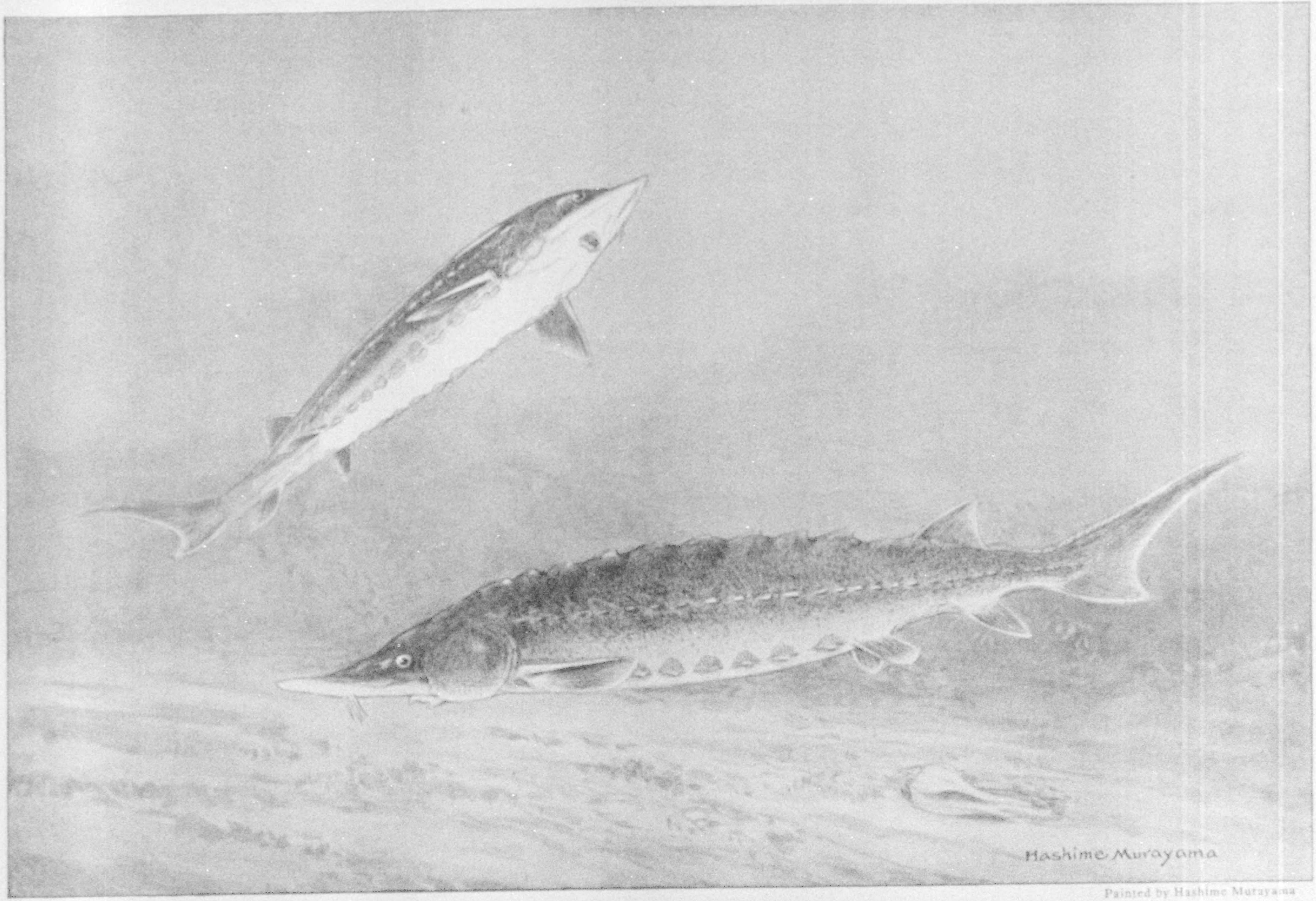
HALIBUT (*Hippoglossus hippoglossus*)

The Halibut is the largest fish of the Flounder family, claiming all seas in regions north of 41 degrees for its habitat. Species inhabiting cold water have eyes and color on the right side. The Halibut is found mostly in deep gullies between offshore banks and on the outer edges of those banks in water 100 to 350 fathoms deep. Like the Flounder, the Halibut buries itself in the sand to hide from its enemies and to catch its prey.



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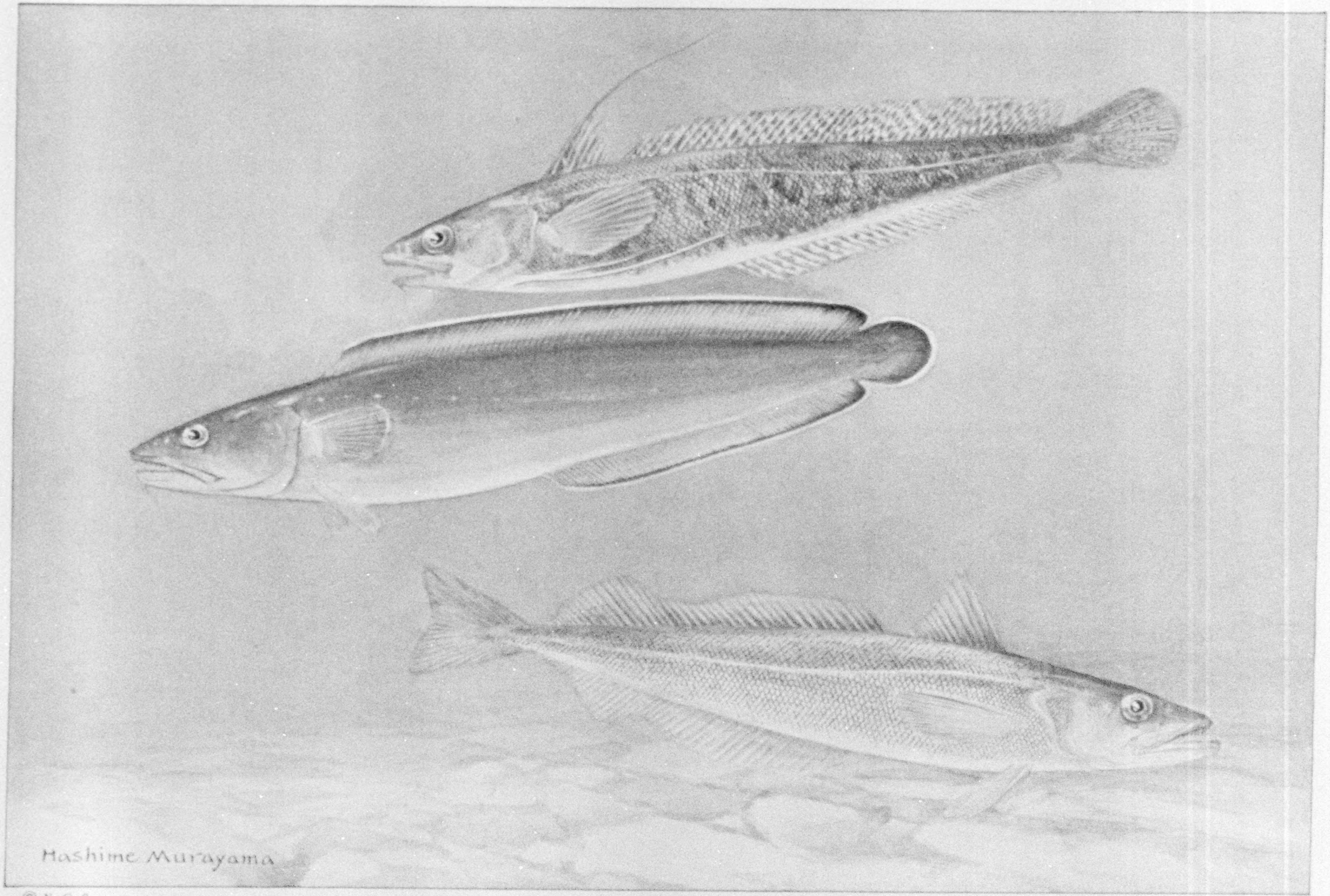
COMMON STURGEON (*Acipenser sturio*)

Common Sturgeons are found from the Carolina coast to the Maine Gulf, with the Delaware River the region of their greatest abundance. Once they were plentiful, but over-fishing has so reduced the supply that the taking of one is decidedly rare, and when taken living it sells for several hundred dollars. The spawning season is regulated somewhat by the temperature of the water, May being the usual month in the Delaware River. The eggs are used in making caviar.



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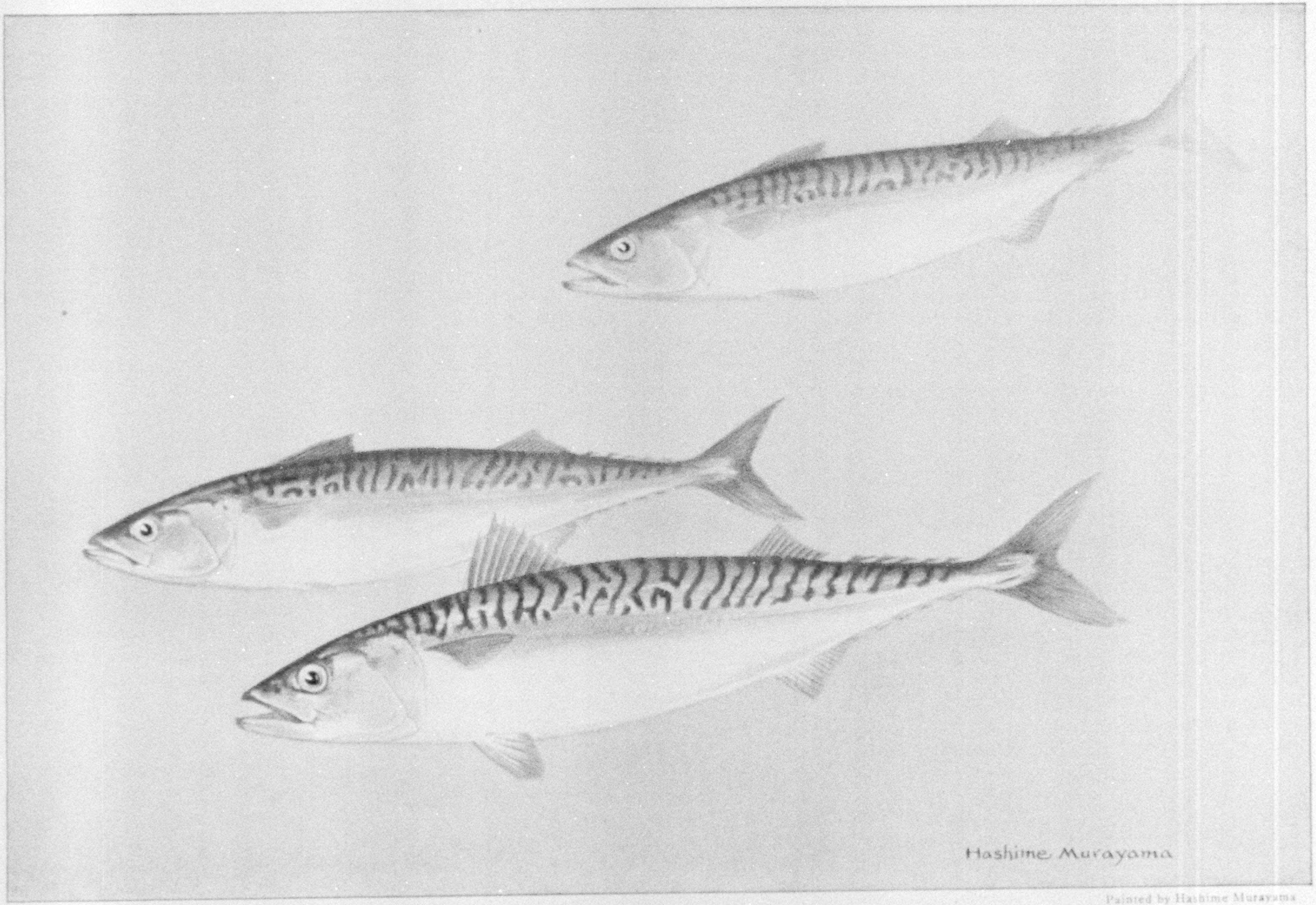
SQUIRREL HAKE (*Urophycis chuss*) [at top]; CUSK (*Brosmius brosme*) [center]; WHITING (*Merluccius bilinearis*)

The Squirrel Hake, belonging to the Codfish family, ranges from Labrador to Hatteras on the Atlantic coast. It is used in making boneless Cod, and its air bladder is used in the manufacture of isinglass and glue. The Cusk, also a member of the Codfish family, is widely caught in the present New England fisheries. The Whiting, sometimes known as the Silver Hake, commonly inhabits the middle depths of the continental slope.



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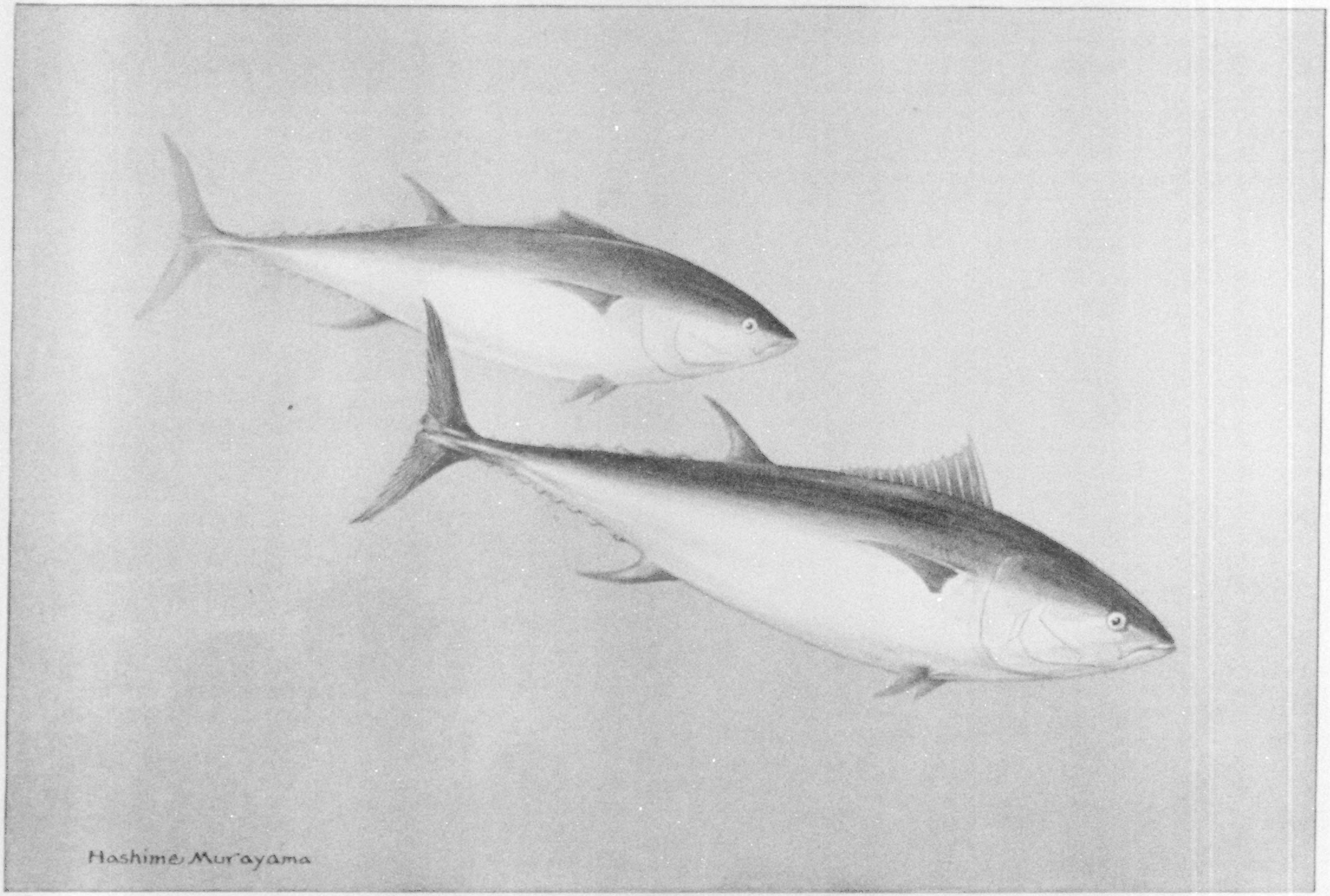
MACKEREL (*Scomber scombrus*)

The Mackerel is a member of the family which includes the Bonito, Tuna, Kingfish, and the Wahoo or Peto. It ranges between Hatteras and the Straits of Belle Isle, appearing on the Hatteras coast in early spring, and gradually migrating north. The spawning season extends from May to July, the grounds being in rather deep water off the coast between Long Island Sound and the Gulf of St. Lawrence. The Mackerel has many enemies, among which are the Gannets, Porpoises, Whales, Sharks, Squids, and Dogfish.



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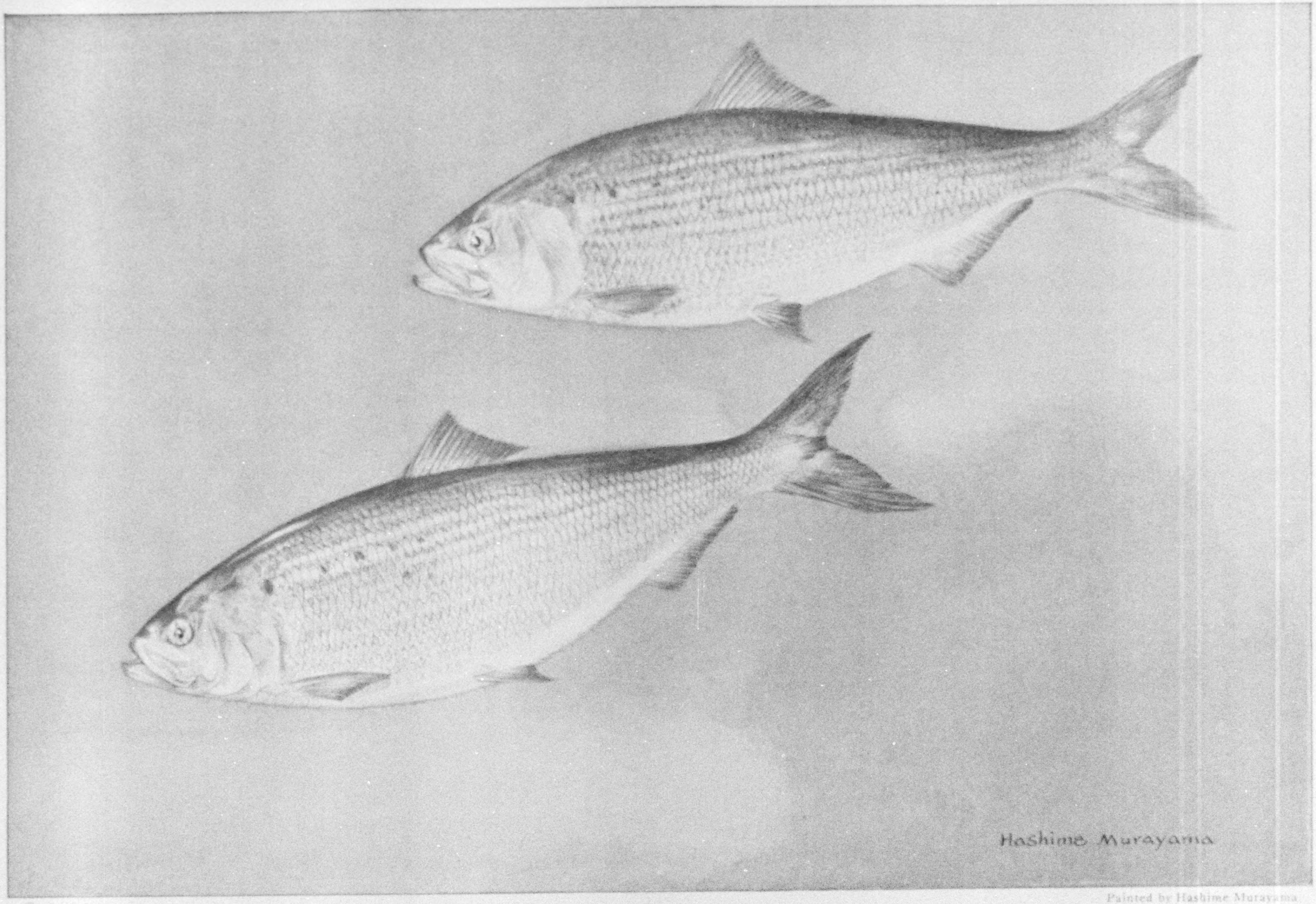
TUNA (*Thunnus thynnus*)

The Tuna belongs to the Mackerel family, of which it is the largest representative, and has a wider distribution than most fishes. It is found in all warm seas, and occurs as far north as Newfoundland. On the North Atlantic coast it is caught from early summer to October. During one season a single fisherman harpooned thirty Tuna of an average weight of 1,000 pounds, although some weighing up to 1,500 pounds have been taken.



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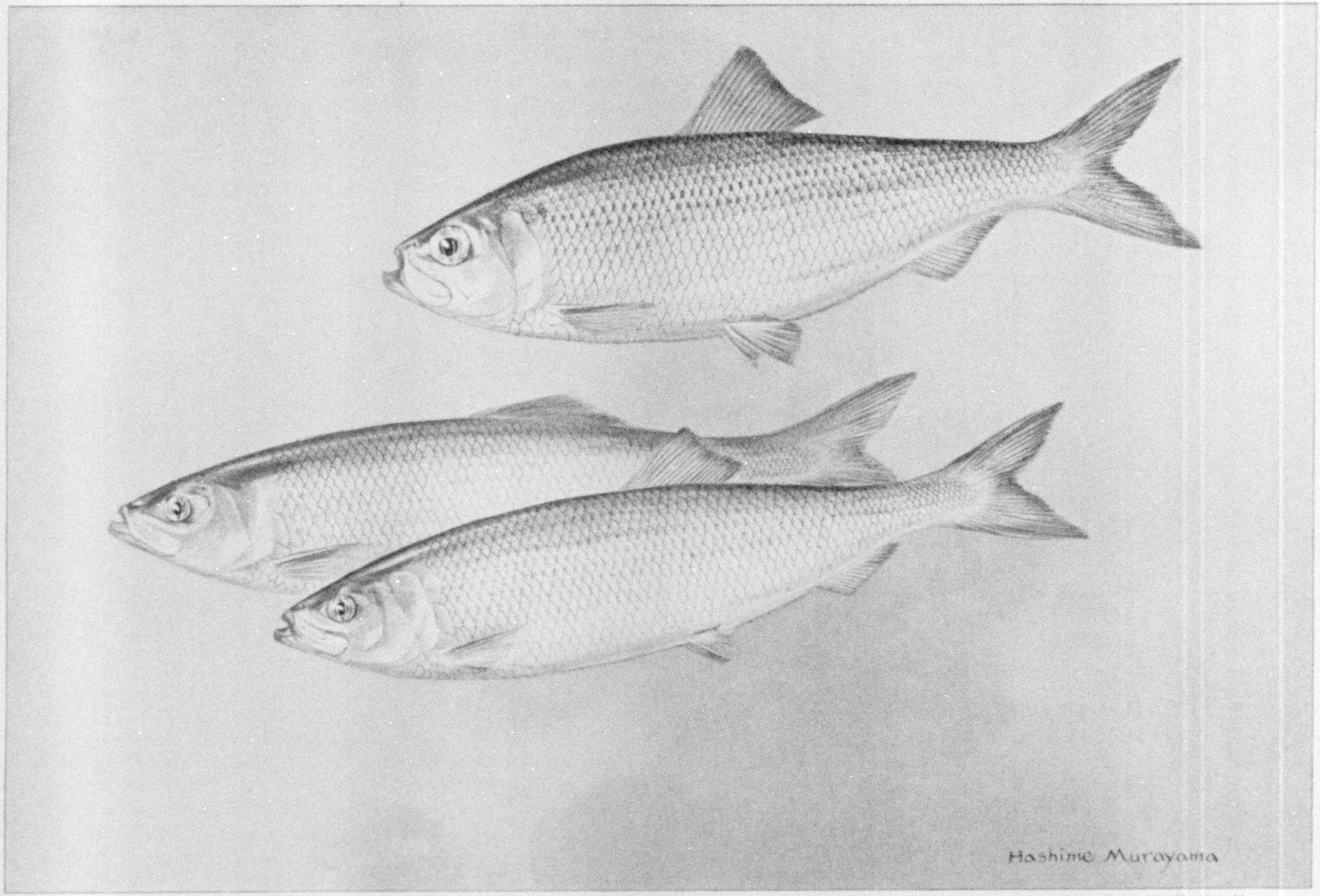
SHAD (*Alosa sapidissima*)

Belonging to the Herring family, the Shad spends its spawning season in the rivers and the rest of its life in deep sea waters. Because it is not within reach of fishermen except at the spawning season it is especially liable to extinction by over-fishing, and were it not artificially propagated it now would rarely appear on the American dinner table. Through the work of the United States Bureau of Fisheries it has been established along some 2,000 miles of Pacific Coast shore line, from the Atlantic seaboard, where it is indigenous.



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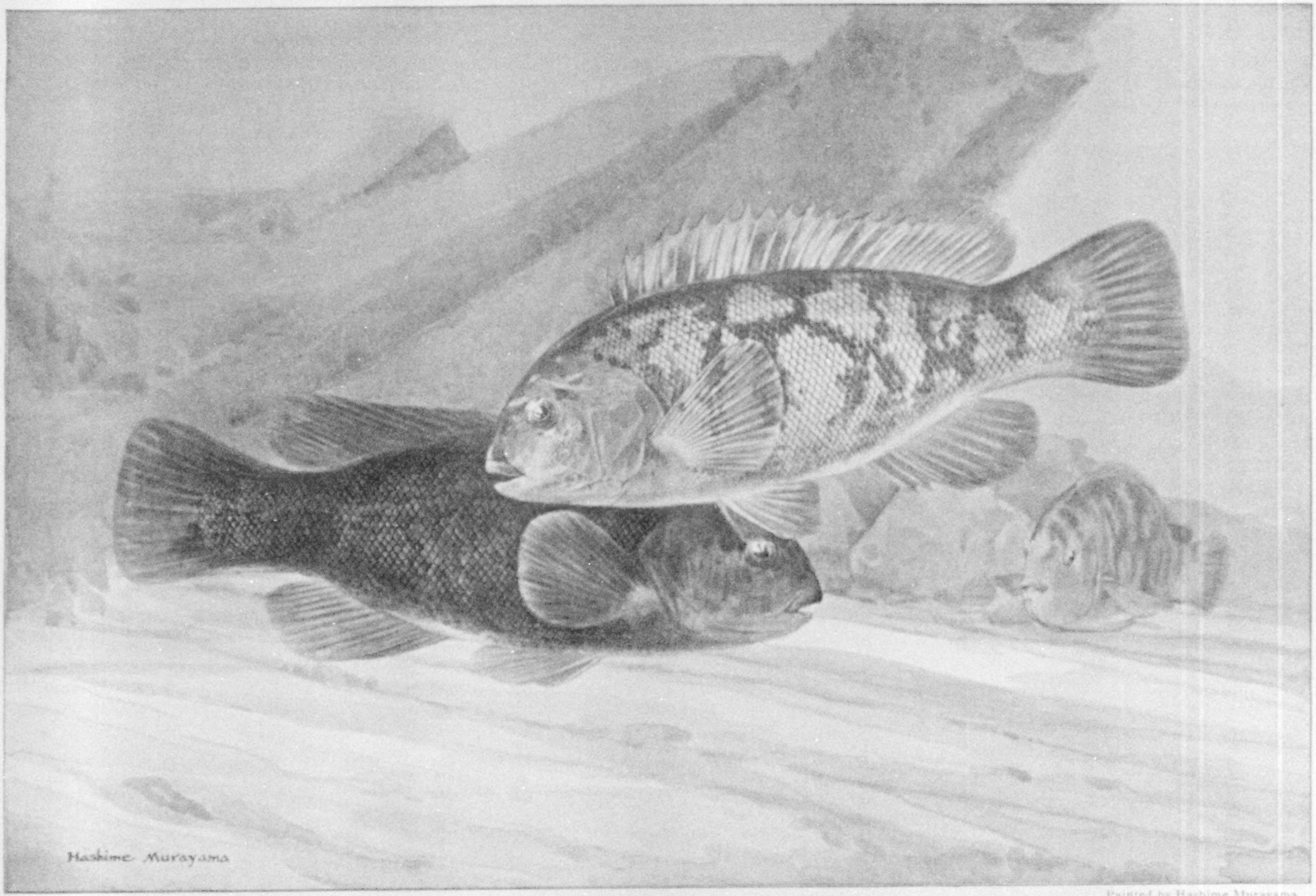
ALEWIFE (*Pomolobus pseudoharengus*) [at top]; HERRING (*Clupea harengus*)

The Alewife, variously known as the Branch Herring, the Blear-eyed Herring, the Wall-eyed Herring, and the Gaspereau, is found on our Atlantic coast from the Carolinas northward. The Herring family includes the Sardines, Alewives, Shad, and Menhaden. *Clupea harengus* is probably the most important food fish in the world, and is distributed throughout the North Atlantic Ocean. Unlike most fishes, the Herring is particularly fine-flavored at spawning time.



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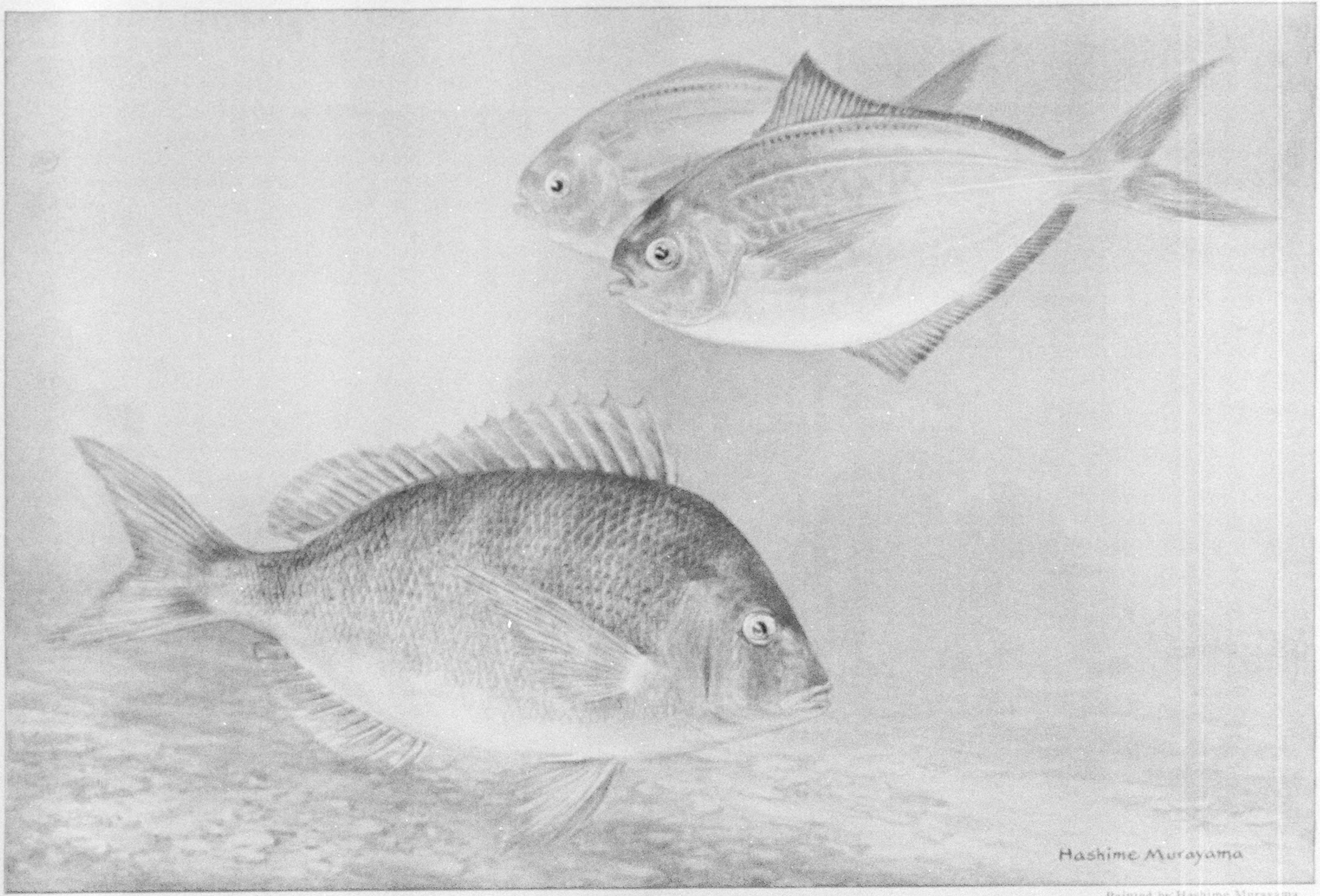
TAUTOG (*Tautoga onitis*)

The Tautog, a stockily built member of the Wrasse family, ranging from New Brunswick to the Carolinas, is variously known as the Tautog or the Blackfish. Its food consists mainly of hard-shelled Mollusks, Squids, Scallops, Crabs, Barnacles, and Sand Darters. It eats shell and all, and regurgitates the indigestible parts. The Tautog's scales and mouth are hard, and it possesses an eel-like slipperiness.



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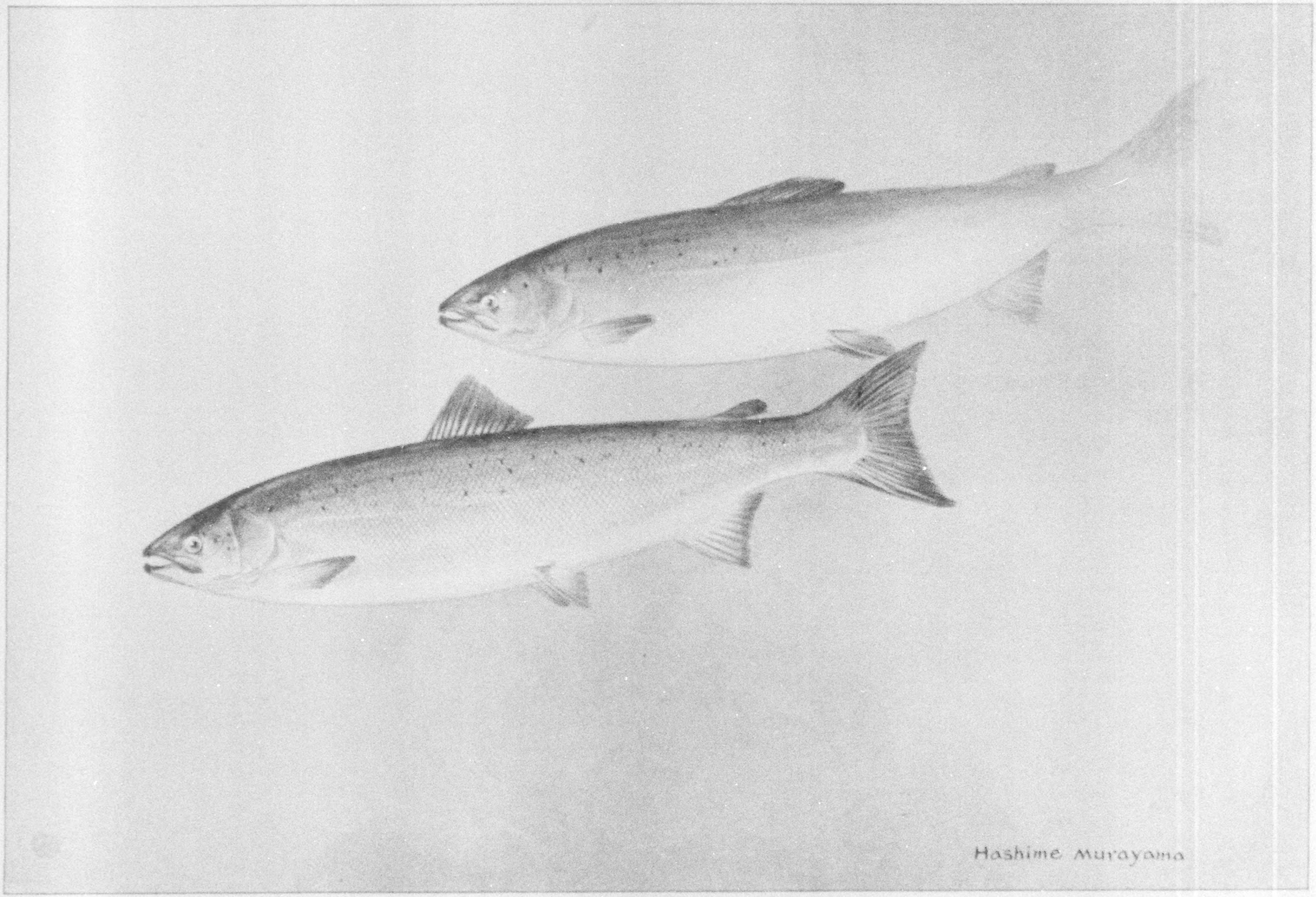
BUTTER-FISH (*Poronotus triacanthus*) [at top]; SCUP (*Stenotomus chrysops*)

Known as the Dollar-fish in Maine, the Butter-fish in Massachusetts and Norfolk, and the Pumpkin Seed in Connecticut, *Poronotus triacanthus* arrives and departs with the Mackerel. It has the habit of accompanying, in small groups, the Sun-squall Jellyfishes, but whether for the shelter of the Sun-squall's disks, or for the diet of soft-bodied invertebrates entangled in the latter's tentacles, is not known. The Scup of New England is the Porgy of New York, and the Fair Maid farther south.



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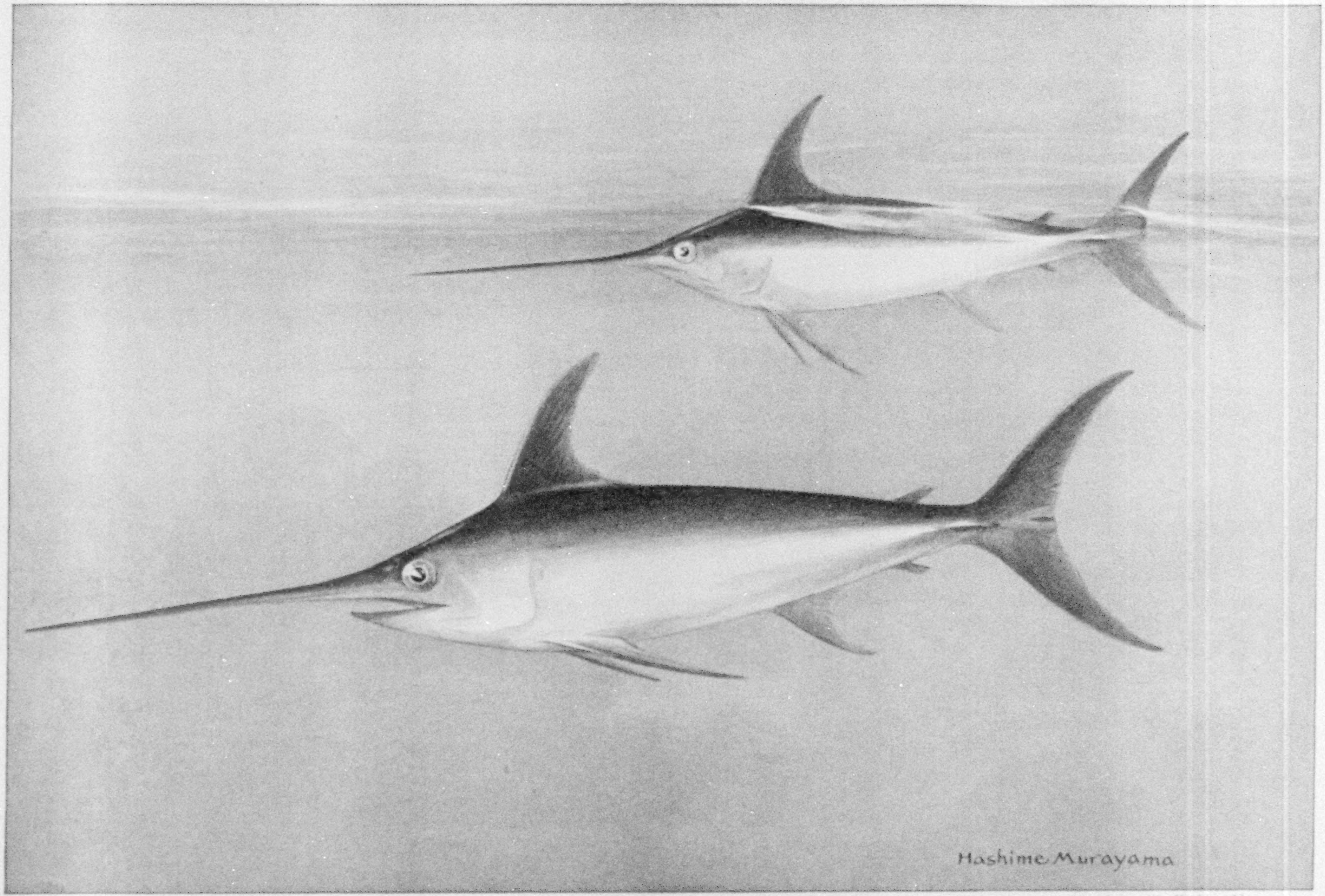
ATLANTIC SALMON (*Salmo salar*)

At least half of the Salmon's life is spent in the ocean, the other half in fresh water, where it spawns. Although temperature changes do not influence its movements as much as those of other species, the eggs are not deposited before the water has fallen to 50° F. It seems to enter the rivers on a rising temperature, and may be found in the Connecticut in April and May, in the Merrimac in May and June, and in the Penobscot in June and July.



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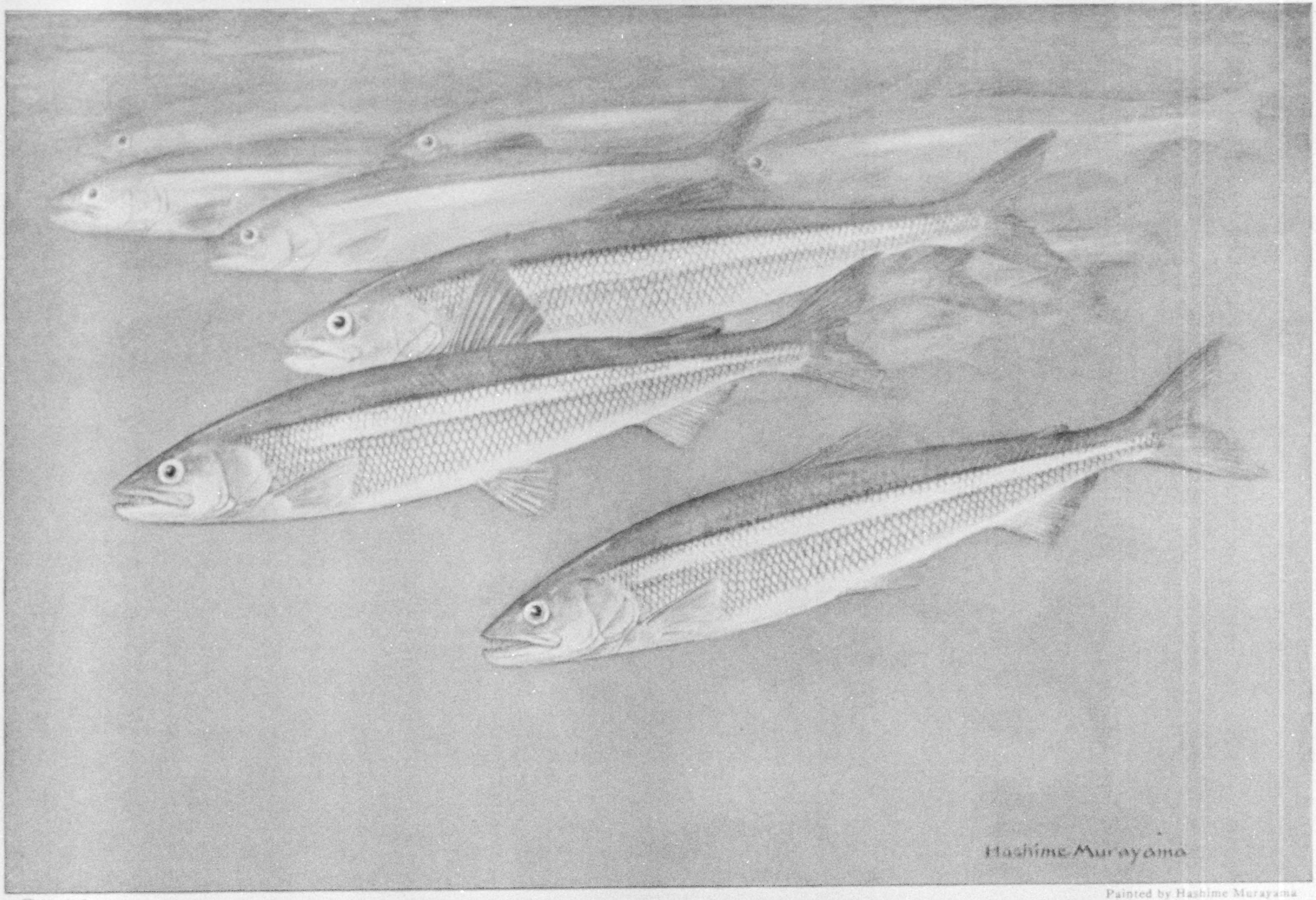
SWORDFISH (*Xiphias gladius*)

Sometimes reaching a weight of 800 pounds, the Swordfish rivals the Shark in size and strength. Its distribution is wide; it is the *Zwaard-fis* of the Dutch, the *Soña* of the Italians, the *Espada* of the Spaniards, and the *Épée de Mer* of the French. The Swordfish is a worthy antagonist, and it is recalled that many a small vessel has limped into port leaking badly as a result of attacks by wounded Swordfish.



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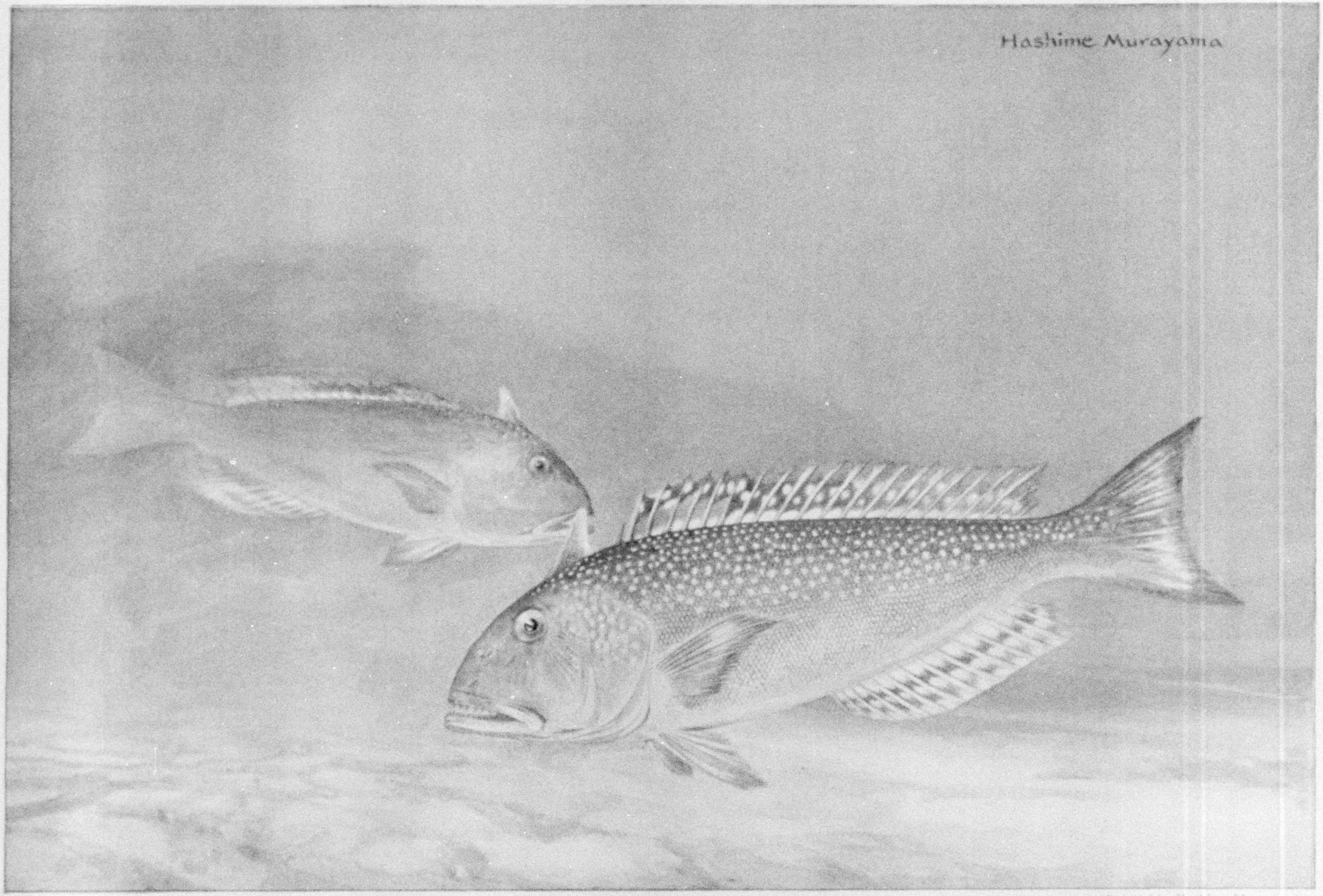
SMELT (*Osmerus mordax*)

With a range from the Virginia Capes to the St. Lawrence Gulf, *Osmerus mordax* is the leading American Smelt. Large quantities of Smelts are taken during the winter, most of which are frozen and shipped to the larger cities. Those shipped in their natural state are termed Green Smelts and are rated very high for table use. This fish is structurally similar to the Salmon, except in size. The stomach of the former is a blind sac with two openings close together, while that of the Salmon is siphon-shaped.



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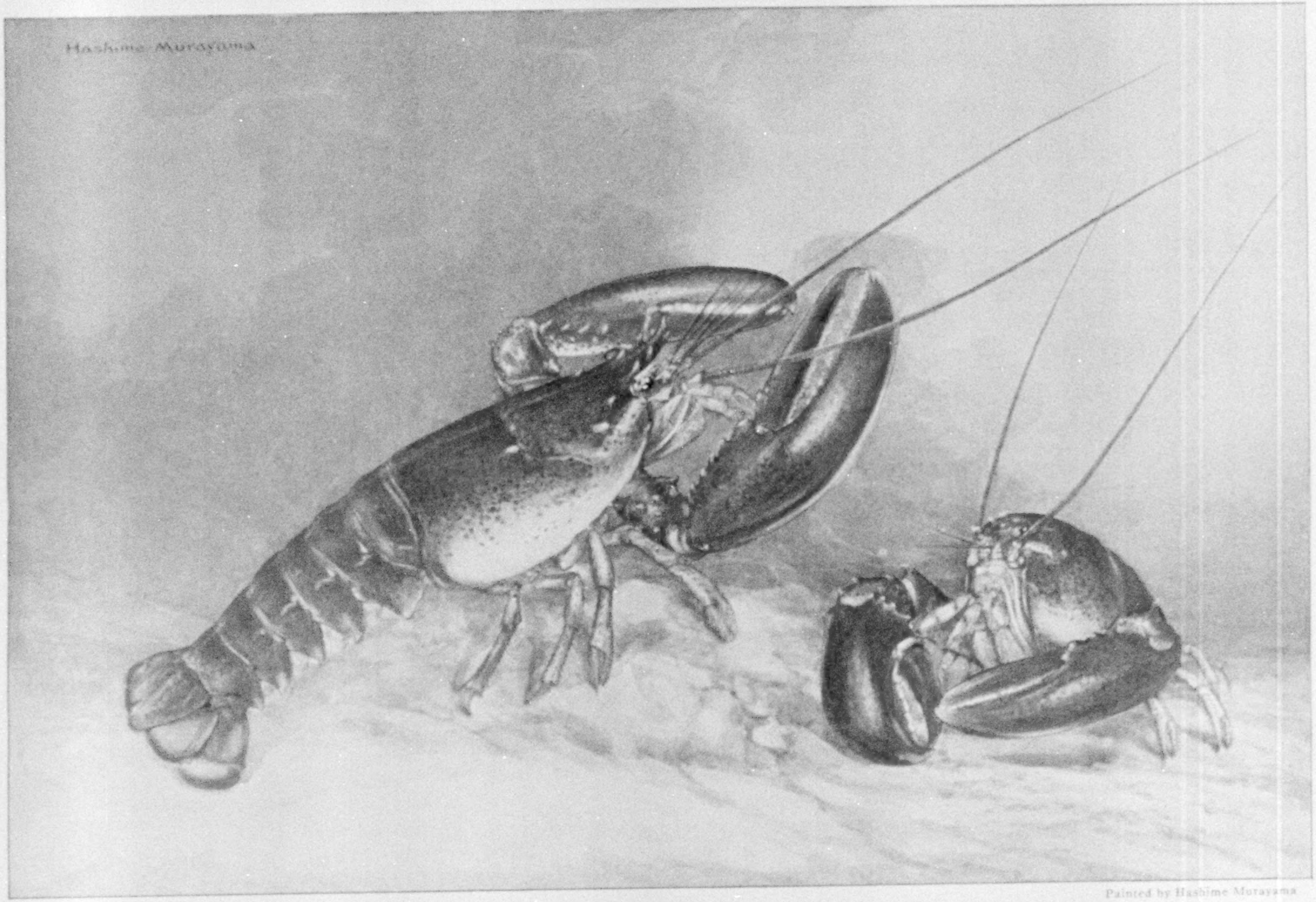
TILEFISH (*Lopholatilus chamaeleonticeps*)

In 1879 a New England trawler, fishing for Cod off the Nantucket coast, took five thousand pounds of Tilefish—the first of which there is any record. A few years later literally millions of Tilefish were found dead, floating on the waters of the North Atlantic. The solution of the mystery of their destruction and the prediction of their return constitute a notable chapter in the history of marine biology.



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AMERICAN LOBSTER (*Homarus americanus*)

With the supply constantly growing scarcer, and prices ever rising, the Lobster fisheries of New England appear to be doomed unless new legislation, framed in the light of the results of the biological investigations of the United States Bureau of Fisheries, is enacted promptly. The steps recommended include the licensing of every Lobster fisherman and the adoption of a standard trap or pot which shall permit the escape of all Lobsters under nine inches long and prevent the entrance of all over eleven inches.

The dates of their first appearance in any given river closely agree with the movements of the Shad. The Branch Herring usually precedes the Shad by a fortnight or so and the Glut Herring comes about the middle of the Shad season.

Little is known of the food of the river Alewives and of their salt-water habitat, although it is believed that they, like the Shad, feed largely on living crustaceans. In the rivers they seem to eat very little.

They spawn after entering fresh water—the Branch Herring when the temperature has reached 55 to 60 degrees Fahrenheit and the Glut Herring when it attains 70 to 75 degrees.

The late Professor Baird regretted the absence of effort to restore the Alewife to its primitive abundance, and declared in one of his reports to Congress that the Alewife is in many respects superior in commercial and economic value to the Herring. He noted that it is a much larger and sweeter fish than the Herring, being more like the Shad. He attributed the diminution of the Alewife supply to the erection of dams and other barriers, and expressed the belief that the gradual wearing down of the Cod, Haddock, and Hake fisheries along the American coast is due more to the diminution of the Alewife supply than to any falling off in the number of sea Herring as food for these fishes.

HERRING (Clupea harengus)

(*For illustration see Color Plate IX*)

The Herring family includes not only the Herrings, but also the Sardines, the Alewives, the Shads, and the Menhadens.

Distributed throughout the entire North Atlantic Ocean, the Herring, *Clupea harengus*, is probably the most important food fish in the world.

With so many other species in competition, the Herring has never attained the popularity on the American dinner table that it has on those of Europe, where it forms a staple diet for millions; but even in our waters it is widely taken north of Cape Cod. Most of the fish are sold fresh, either for human food or Cod bait. Immense quantities of the young ones are packed and sold as Sardines.

Years ago Professor Huxley estimated that three billion Herring were being caught annually. With the growth of the fishing industry in European waters, it has been estimated that the annual catch now exceeds ten billion. A single shoal sometimes covers six square miles and is estimated to contain at least half as many Herring as the whole world catches in a year. Many such shoals are known to exist.

The Herring, unlike most fishes, is particularly fine-flavored at spawning time, and the fisheries are carried on busily during that season. Usually the Herring is taken with gill nets anchored below the surface of the waters, in which so many are sometimes enmeshed as to sink the buoys. Other forms of taking it are by means of weirs and torching. The latter is particularly resorted to when cold weather sets in. A torch is set in the bow of the boat. The fish rise to the surface as the vessel glides swiftly along, and are scooped in without difficulty.

The food of the Herring consists principally of "red feed" and Shrimp. They are in turn preyed on by a list of enemies as long as the moral law, ranging from finback whales, porpoises, and seals to Cod, Dogfish, and Squids. When schools of enemy fish attack the Herring the sea gulls are always on the job to gather up the scraps of the fray.

The life history of the Herring has never been completely worked out. The facts known indicate that it lives in deep water off the coasts, coming inshore to spawn. There seems to be a number of distinct races, differing as to size, spawning time, and various other qualities and traits, each race swimming in a separate school and having its own particular time and ground for spawning. The number of eggs laid by a female ranges from 10,000 to 50,000, it is said.

TAUTOG (Tautoga onitis)

(*For illustration see Color Plate X*)

The Tautog is a species of the Wrasse family, stockily built, with a range from New Brunswick to the Carolinas. North of New York it is called the Tautog, while New York knows it as the Blackfish. Farther south it is called the Oyster Fish. The average weight is about three pounds, though occasionally one is taken weighing as much as 22 pounds. It has hard scales, a hard mouth, and a slipperiness that is eel-like.

The Tautog's food consists mainly of hard-shelled Mollusks, Squids, Scallops, Crabs, Barnacles, and Sand Darters. It eats them, shells and all, and then regurgitates the undigestible parts.

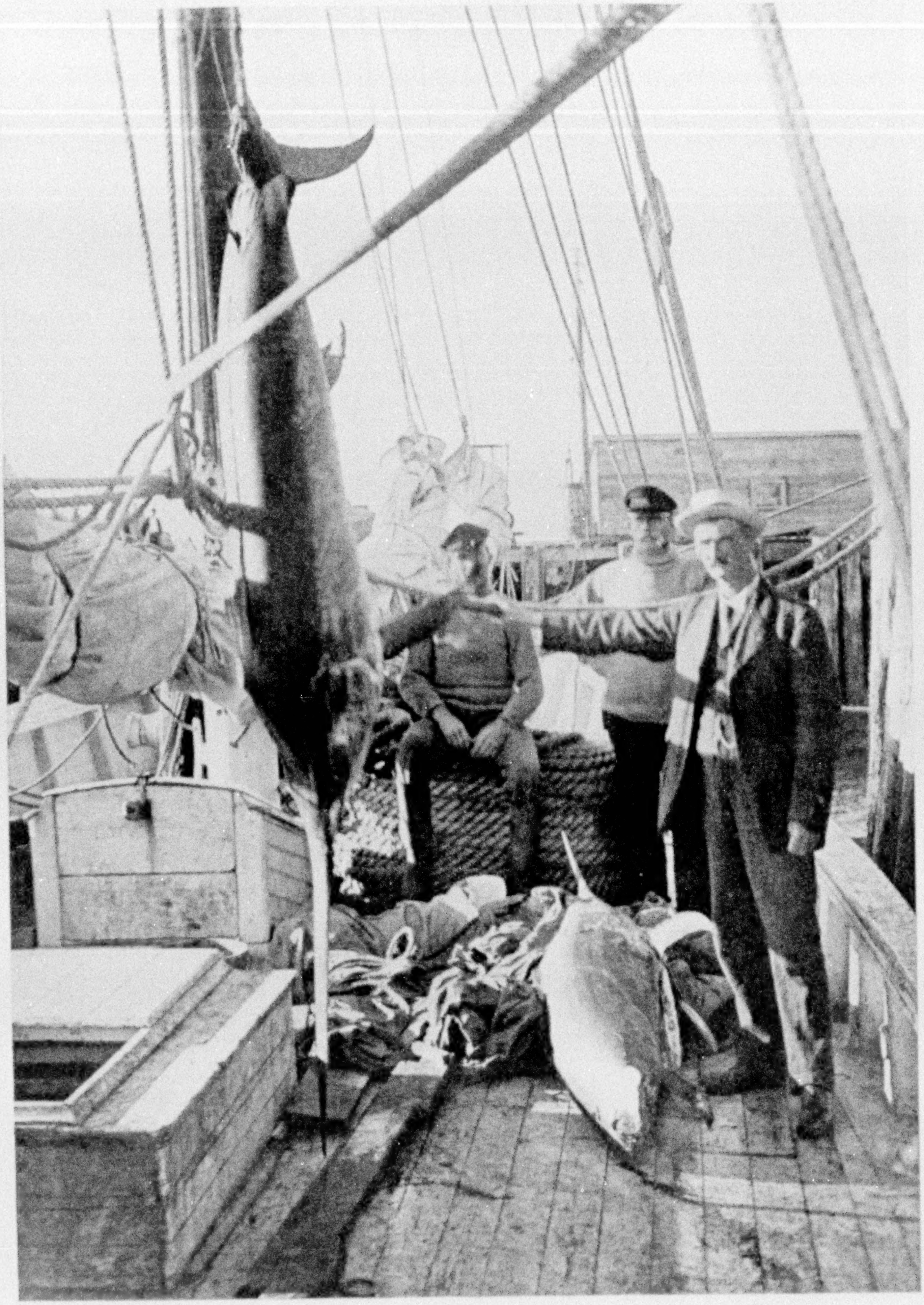
Close relatives of *Tautoga onitis* are El Capitan, or the Hogfish, of Florida waters and the Fatheads or Redfishes of the southern California coast.

All of the Tautogs belong to the Wrasse family, *Labridæ*, which is one of the largest known, including some 450 species, divided into about 60 genera.

BUTTER-FISH (Poronotus triacanthus)

(*For illustration see Color Plate XI*)

The Butter-fishes form a large group of small fishes, many famous for the fine quality of their flesh. *Poronotus triacanthus* is known as the Dollarfish in Maine, the Butter-fish in Massachusetts and Norfolk, the Pumpkin Seed in Connecticut. It is a summer visitor, appearing and disappearing with the Mackerel. It has the habit of accompanying, in groups of ten or twelve, the Sun-squall Jellyfishes in the inshore waters of the middle Atlantic, seeming to seek shelter from its enemies under the Sun-squall's disks, or possibly finding there



SWORDFISH TAKEN IN CAPE BRETON WATERS

It has long been the opinion of ichthyologists that the Swordfish's spawning ground is in the Mediterranean Sea. The fact that small ones are constantly caught in the Mediterranean, but that only larger ones are taken in American waters, seemed to justify the conclusion that they did not spawn on this side of the Atlantic. But recently a small Swordfish weighing less than eight pounds was taken near Boston and a female containing spawn was landed at New Bedford. This evidence has served to reopen the question.

a diet of the soft-bodied invertebrates that are constantly becoming entangled in the tentacles of the Jellyfish. But its position is not always a safe one, since it sometimes is lassoed in these same tentacles and eaten by its host.

The Harvest Fish (*Peprilus paru*), which ranges from Cape Cod to Brazil, but is especially abundant off the Virginia capes, is another member of the Butter-fish family. It reaches a length of 10 inches, and has the peculiar habit of swimming under the Portuguese Man-of-War, probably gathering the scraps that fall from the table of that fish, as well as enjoying protection from its enemies.

The Poppy Fish (*Palometa simillima*) found on the sandy shores of California is a close duplicate of the Dollarfish, and the San Francisco epicure pays a high price for it, supposing it to be Pompano, though admitting that the Pompano of the Florida coast has a finer flesh and better flavor.

SCUP (Stenotomus chrysops)

(*For illustration see Color Plate XI*)

The Scup belongs to the Porgy family, which also includes the Porgies and the Sheepsheads. The Scup (*Stenotomus chrysops*) ranges between Cape Cod and the Carolinas. It is the Scup in New England, the Porgy in New York, and the Fair Maid farther south, getting back to the Porgy again at Charleston. New Englanders often call it the Scuppaug, a corruption of the Narraganset Indian name, Muscuppanog. As a food fish it is one of the commonest and is highly esteemed for its flavor. A bottom-feeder, the Scup's diet is largely made up of Mollusks, small crustaceans, and worms. Along the South Atlantic coast the Scup is replaced by a closely related species *Stenotomus aculeatus.*

ATLANTIC SALMON (Salmo salar)

(*For illustration see Color Plate XII*)

Eighteen hundred years ago Pliny wrote that the Salmon surpassed all the fishes of the sea in the river Aquitania. That is the earliest allusion to *Salmo salar* known in literature, and although scores of other species have been identified, still *Salmo salar* is *the* Salmon outside of the canneries of the Pacific, which utilize other species.

The species inhabits both sides of the Atlantic and ascends the rivers as far as it can go in the spawning time, going up the St. Lawrence and through Lake Ontario to Niagara Falls.

At least half the Salmon's life is spent in the ocean, recalling Izaak Walton's remark that "he is ever bred in fresh rivers and never grows big but in the sea. . . . He has, like some other persons of honor and riches which have both their winter and summer houses, the fresh water for summer and the salt water for winter to spend his life in."

The Connecticut River once teemed with Salmon, but dams exterminated the species therein. The same fate has befallen them in many other rivers.

The young fish stay in fresh water for one or two years, and then wander out to sea, although they weigh only a few ounces when they go. There they find congenial food and grow rapidly. In that pleasant environment they remain until summoned, as Dr. Goode says, by the duties of family life to return to the narrow limits of the old home. When they live in the lakes they prey on Minnows and other small fishes, but those of the sea delight also in small crustaceans and crustacean eggs, to which they are said to owe the vivid color of their flesh. The habits of successive generations become hereditary traits and the differences in their life histories are held by many authorities to justify the belief that the landlocked Salmon is merely a variety of *Salmo salar.*

Although the Salmon, like the Trout, spawn with a falling temperature, not depositing their eggs before the water has dropped to 50 degrees, they seem to enter the rivers on a rising temperature. In the Connecticut they appear in April and May, in the Merrimac in May and June, and in the Penobscot in June and July.

Temperature changes do not influence the movements of the Salmon as much as those of other species. It is said that two-thirds of the colony belonging to a particular river may be found in it in any season. This high proportion is made up of half the colony, less than a year old, and the breeding fish, which remain in the rivers six or seven months after the spawning season.

When they leave the ocean, they first enter the brackish water at river mouths, where they remain for several weeks; then they start for the spawning grounds, which they usually reach in late summer. At the approach of the spawning season their trim shapes and bright colors disappear, leaving them lank and misshapen, with fins thick and fleshy and skin slimy and blotched. This transformation takes place especially in the males. The jaws become so curved that they touch only at the tip, the lower of which develops into a large and powerful hook, used as a weapon in the savage combats which they stage with their rivals.

When the newly hatched Salmon appear they are about three-fourths of an inch long and the yolk sac is visible on them for from four to six weeks. When this is absorbed the youngling begins to feed, readily seizing any minute floating object. In two months it has grown to one and one-half inches and begins to assume the vermilion spots and transverse bars which it retains until it begins its descent to the sea, when it adopts a uniform bright silvery coat. After remaining in the sea for a period of from 4 to 28 months, it heads back to land, and then dawns the time that every fisherman loves, for at this stage nothing in the water surpasses it in symmetrical beauty, brilliancy, agility, and pluck. Christopher North has called it "a salmon fresh run in love and glory from the sea. . . . She has literally no head; but her snout is in her shoulders. That is the beauty of a fish, high and round shoulders, short waisted, no loins, but all body and not long of terminating—the shorter still the better—in a tail sharp and pointed as Diana's, when she is crescent in the sky."

SWORDFISH (Xiphias gladius)

(For illustration see Color Plate VIII)

The Swordfish ranges in Atlantic waters from Cuba to Cape Breton. The extent of its range is attested by the fact that the Dutch call it the *Zwaard-fis;* the Italians, *Sofia;* the Spaniards, *Espada;* and the French, *Épée de Mer.* Aristotle named it Xiphius some twenty-three centuries ago. It rivals the Sharks both in size and strength, sometimes reaching a weight of 800 pounds, although most of those caught weigh less than half as much. It usually appears on the shoals and banks in June and stays until the colder fall months set in. It is believed to come out of the deeper waters in search of food, since its spawning grounds are not in shallow regions. It apparently follows the Menhaden and Mackerel. Old fishermen have a saying that where you find Mackerel you may expect Swordfish. When swimming near the surface, it usually comes so close to the top that the tips of its back and tail fins are exposed.

This exposure enables the fisherman to detect its presence, and, being given to swimming slowly at times, it is easily overtaken by a schooner with a light breeze to drive it. Every now and then it leaps entirely out of the water, and old fishermen attribute this to tormenting parasites; but modern authorities disagree with that theory. Be that as it may, one authority tells us that it strikes with the force of fifteen double-handled hammers and with the velocity of a swivel shot.

Its stupidity in attacking ships and other objects sailing the seas is so great that Oppian tells us that "Nature her bounty to his mouth confined, gave him a sword, but left unarmed his mind."

The feeding habits of the Swordfish are striking. It is said that it swims under a school of small fishes, and then, suddenly rising to the top, thrashes about with its sword, killing a number of its prey in the act. These it promptly devours and then repeats the performance.

It is said the Swordfish never comes to the surface except in moderate, smooth weather. Once it is sighted the lookout at the masthead "sings out," and the skipper takes his place in the "pulpit," on the end of the bowsprit, holding the harpoon pole in both hands by the small end. Directing the helmsman, he guides the vessel toward the quarry, and when the fish is eight or ten feet off the prow, rams the harpoon into its back. The fish is allowed plenty of line, and then two men go out in a yawl and maneuver the victim alongside, where it is killed with a whale lance.

There are some of the thrills of whaling in swordfishing, since there is no slow baiting or careful waiting and no bother with nondescript bait-stealers. The Swordfish is a worthy antagonist, and many a vessel has limped into port, leaking badly as a result of attacks by wounded Swordfish. Occasionally a small boat is attacked and the sword rammed clear through its side. Once the sword punctured two inches into the heel of a sailor standing in the boat.

SMELT (Osmerus mordax)

(For illustration see Color Plate XIV)

The Smelts are structurally akin to the Salmons, being largely like them except in size. The other chief difference is in the form of the stomach, which, in the Smelts, is a blind sac, with the two openings close together, while in the Salmons it is siphon-shaped. All of the species are small and most of them stick strictly to the sea, although a few go up rivers to spawn, after the fashion of the Salmons. All of the abundant species are edible, the flesh being extremely delicate and often full of a fragrant, digestion-aiding oil.

The leading American Smelt is *Osmerus mordax,* a shapely little creature that is rarely longer than 10 inches. It ranges along the coast from the Virginia Capes to the St. Lawrence Gulf, and enters the streams and brackish bays to spawn during the winter months, when it is taken in great numbers, with hook and line and in nets.

In going up streams some of the Smelts have lost their way and become landlocked in numerous lakes such as Champlain and Memphremagog.

The fishermen take vast quantities of them during the winter, most of which are frozen and sent to the larger cities. Those that are not frozen are termed Green Smelts and are rated very high on the scale of finely flavored fish. Shrimps and other small crustaceans form the favorite food of this species.

Captain John Smith, of Jamestown fame, wrote in 1622 that there was such an abundance of them that the Indians dipped them up from the rivers with baskets used like sieves.

Another Smelt that belongs in the fine-food category is the Capelin, found from Cape Cod to the Arctic on the Atlantic coast and in Alaskan waters on the Pacific. Its eggs are deposited in vast quantities in the sands along the shore. These, washed up on the beaches, present the appearance of masses of little fishes, eggs, and sand. Hatching takes place in about thirty days, and the youngsters ride the first waves out into the sea.

Still another Smelt that meets with favor wherever it abounds is known as the Eulachon, or Candlefish (*Thaleichthys pacificus*), which lives in great numbers on the Pacific coast from Oregon northward. It is said to be unsurpassed in delicacy of flavor, which is described as exceeding that of any Trout. It is remarkable for its extreme oiliness, which is so great that, when dried and a wick put into its body, it serves as a candle; hence its name. The oil is sometimes extracted and used as a substitute for cod-liver oil. At ordinary temperatures it is solid and lardlike in its consistency.

TILEFISH (Lopholatilus chamaeleonticeps)

(*For illustration see Color Plate XV*)

There is no greater wonder story of the seas than the history of the Tilefish. To-day some connoisseurs pronounce it second only to the Pompano in flavor, and it is receiving much attention from those who are not Bourbons in matters of food.

Prior to 1879 this fine fish had no place in the roster of known fishes. In that year a New England trawler, fishing for Cod off the Nantucket coast, took 5,000 pounds of Tilefish, the first of which there is any record. Whether eaten fresh, salted, or smoked, the samples the trawler took home proved attractive.

For three years there was widespread interest in this newly found food fish. Then, in April and May, steamers arriving from Europe reported seeing myriads of dead Tilefish. One steamer reported that it had sailed through 150 miles of them, and data gathered indicated that perhaps 7,000 square miles of sea surface was strewn with the victims of some untoward circumstance of the sea. It was estimated that the total number of dead fish might reach a billion and a half.

There were no signs of disease and no evidences of parasitic infection. Neither could the calamity be accounted for on the basis of attack by other creatures.

All sorts of theories were advanced to explain the catastrophe—submarine volcanoes and poisonous gases among them.

It had been noted, however, that there was a strip of water, lying on the border of the Gulf Stream slope, between the Arctic current and the cold depths of the sea, which was warmer in 1879 and 1880 than the normal water of that region. Dredging in this water had revealed many species of marine invertebrates characteristic of the waters of the lower latitude, a sort of tropical faunal peninsula in the sea.

In 1882, after the vast schools of Tilefish had disappeared, this region was resurveyed. It was found that the water was colder, and that the marine life that formerly occupied this thermal peninsula had disappeared. What had happened was that northern gales had driven Arctic ice down into the area and had made the water too cold for the Tilefish to bear.

It was predicted that if this were the correct explanation, and if the water came back to its usual temperature again, the Tilefish would ultimately reappear. But years went by and not a single survivor of the catastrophe was found. Fears began to be entertained that the species had been wholly exterminated by the calamity that had befallen it.

But in 1892 the *Grampus* caught eight. Increasing catches with successive years showed that the Tilefish was gradually reestablishing itself, just as the scientists had predicted it would.

But after the Tilefish appeared again the task arose of introducing it to the dining table of the American people. Possessed of a flesh of fine texture and good flavor, the difficulty lay only in the inertia of the people against trying new kinds of food. The Bureau of Fisheries, however, undertook propaganda in favor of the Tilefish and met with fair success. For awhile it was the most advertised fish in American waters. At present it has to rely on its own flavor to carry it to a wider and disinclined-to-try-new-things clientele.

AMERICAN LOBSTER (Homarus americanus)

(*For illustration see Color Plate XVI*)

The American Lobster is an edible crustacean found on the coasts of the North Atlantic Ocean and the Mediterranean Sea—on our coast especially from Delaware to Labrador. It inhabits waters from the shore out to the 100-fathom line and is most numerous on the shores of Maine and Nova Scotia. It prefers rocky bottoms, though it may be found in other environments, and usually, though not without exception, leaves the shallower waters during the winter months and finds temperatures more to its requirements beyond the 100-fathom line.

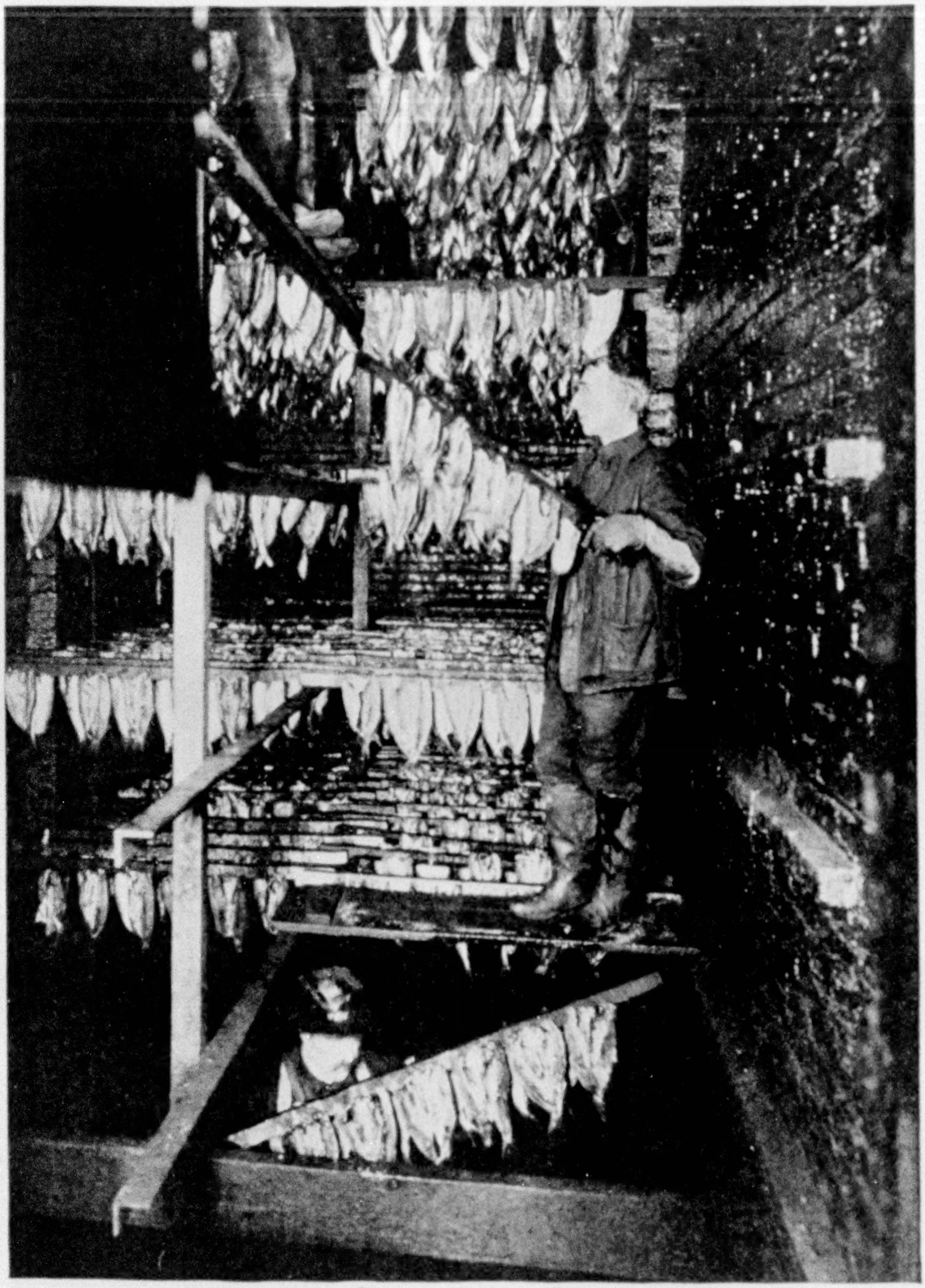
All kinds of animals, both living and dead, and some vegetable matter are pleasing to its appetite. Although dangerous prey to attack, the Lobsters, in spite of their hard shells, powerful claws, and burrowing habits, fall victim to the Cod, the Tautog, the Skate, and the Dogfish, which annually destroy millions of them, particularly the young ones, the egg-bearing females, and the molting adults.

The effect of overfishing for Lobsters shows more in the steady decline in the size of those taken than in the diminution of numbers. The provision of a closed season does not accomplish much, since the female carries her spawn attached to her body for about ten months. Regulations requiring the release of females carrying spawn—"in berry," as that condition is known to the Lobster fishermen—have been made, but are usually ineffective.

The number of eggs produced by a female Lobster varies from 3,000 to 100,000, depending upon the size and age of the individual, maturity being reached in from three to four years. It is believed that it lays only every other year.

The Lobsters are usually caught in traps known as Lobster pots, made of ordinary plastering lath and having a funnel-shaped opening made of tarred netting, permitting easy ingress, but closed against exit. The traps are sunk on Lobster-frequented grounds and baited usually with pieces of stale fish. The European Lobster is nearly always sent to market in the fresh state, while many of those caught in American waters are canned. The European variety seldom reaches a weight of 10 pounds, while those of our shores occasionally weigh as much as 25 pounds. The largest one ever taken, according to the records, weighed 35 pounds.

XUM



Photograph Courtesy of Canadian Government Motion Picture Bureau

PREPARING HERRING TO BE SMOKED: LOCKEPORT, NOVA SCOTIA

No fish contributes so largely to the support of the human race as the common Herring. It is so important and abundant in the fisheries that it is often called "King Herring." It swims closely packed, in enormous schools, often over areas of 6 to 20 square miles, and the annual catch in American and European waters is nearly two billion pounds. In Maine, quantities of young Herring are canned as sardines. One authority has estimated the annual destruction of Herring by man as upward of eleven billion fish, or seven fish to each person in the world.

A SHORT VISIT TO WALES

Historic Associations and Scenic Beauties Contend for Interest in the Little Land Behind the Hills

By Ralph A. Graves

Author of "Fearful Famines of the Past," "The Romance of Geneva," etc., in the National Geographic Magazine

BOTH scenically and historically, the Principality of Wales is one of the most alluring regions of the British Isles, yet comparatively few of the thousands of American tourists who make the transatlantic voyage include it in their itinerary. It is accessible, the hotel accommodations are admirable, the people hospitable, the highways irreproachable, the summer climate delightful. But the average American traveler takes one glance at his guidebook or at the tourist-agency folder and decides to go to the English Lakes district, to Scotland, to the "Lorna Doone" country, or—Paris.

He lacks the courage to wrestle with such place names as Bettws-y-Coed, Bodelwyddan, Dwygyfylchi, Clwyd, Llandudno, Pwllheli, and Pen-y-Gwryd.

BUYING ONE'S TICKET IS A PROBLEM

If the traveler goes to a railway station to get his transportation, he cannot tell where he wishes to go. If a ticket agent in a tourist office asks whether he would prefer to go by this route or by that, with stop-over privileges here or there, the sounds convey to him no impression of any of the places he may have read about.

He may have equipped himself in advance by studying some "easy rule for pronouncing Welsh names," such as "To pronounce *Ll*, place the tip of the tongue back of the upper front teeth and blow through the side of the mouth; *Ch* is a strong guttural having no equivalent in English, but is a prolonged *k* (ach); *W* is *oo*, as in *good*." But if ever he imagined he could remember such rules, he forgets their practical application the moment he hears *glin-div'r-doo-i*, meaning Glyndyfrdwy. It's so much simpler to go elsewhere!

Consequently, at tourist agencies the Welsh window never has a waiting line, and few clerks are able to give one advice as to where to go, how long to stay, and how to come back.

It is a pity, for within this little principality, having an area considerably smaller than New Jersey, one will find the loftiest peak and the finest mountain scenery of England and Wales; the loveliest waterfalls of the British Isles; beaches which rival those of Atlantic City, Deauville, or Brighton; streams that teem with trout and other fish dear to the heart of the angler; footpaths through vale and forest which cannot be surpassed in the Tyrol or the Pyrenees; and the gray ruins of tessellated towers and frowning bastions, each of which has its own tale to tell of romantic adventure and of daring in the Dark or the Middle Ages, when English kings battled ceaselessly to curb turbulent Welsh princes whose chief end and aim in life was warfare.

The courageous visitor who steels himself to suffer the slings and arrows of outrageous orthography and even more outrageous pronunciation of proper names, and decides upon a week-end in Wales faces three instead of the proverbial two horns of a dilemma. Shall he visit Northern Wales, Middle Wales, or Southern Wales?

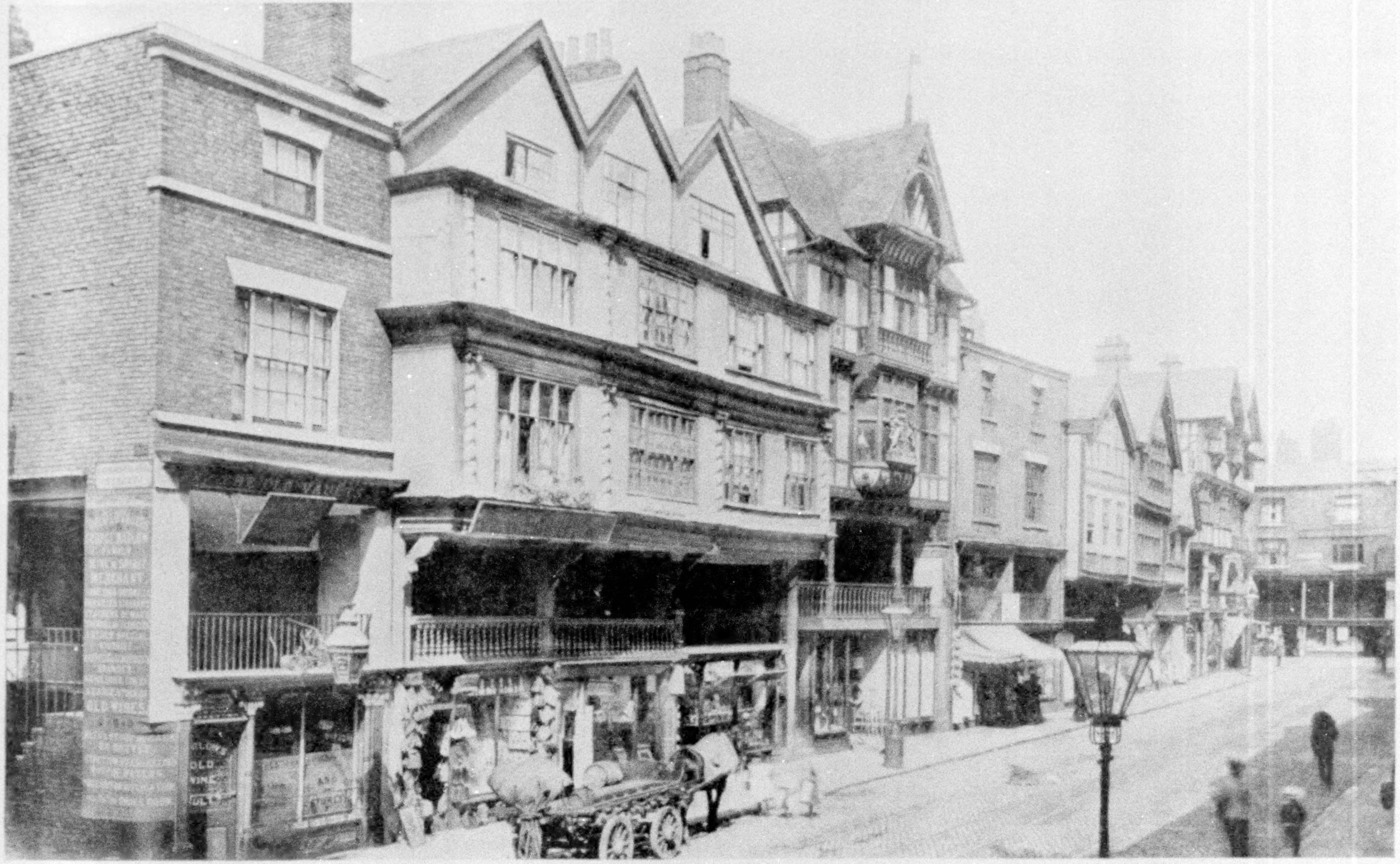
Each section has its definite appeal and each its peculiarities. The guidebook—or more properly books, for some of the best are issued in three volumes, one for each section—does not help in reaching a decision.

We shall let chance decide and go to that section from which David Lloyd George, the Empire's war-time prime minister, hails. We find it is Northern Wales.

A GLIMPSE OF CHESTER

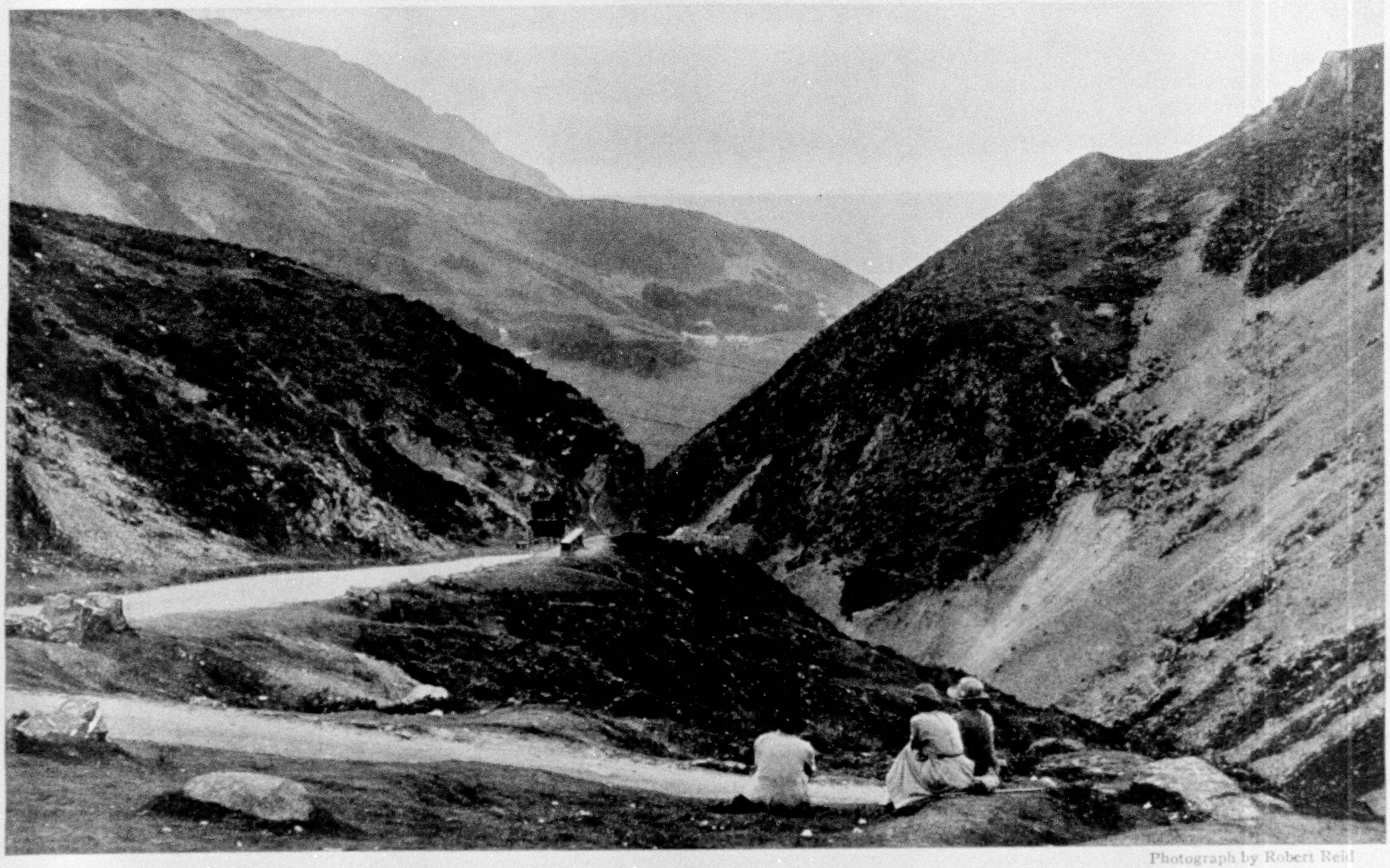
How fortunate, for the gateway to this region is that unique city of western England, Chester, with its mellow old cathedral, its fine walls, and its other-days atmosphere.

By taking an early morning train from London, the hurried visitor is enabled to have a sufficient stop-over in the border



THE TWO-STORY SIDEWALKS IN BRIDGE STREET, CHESTER

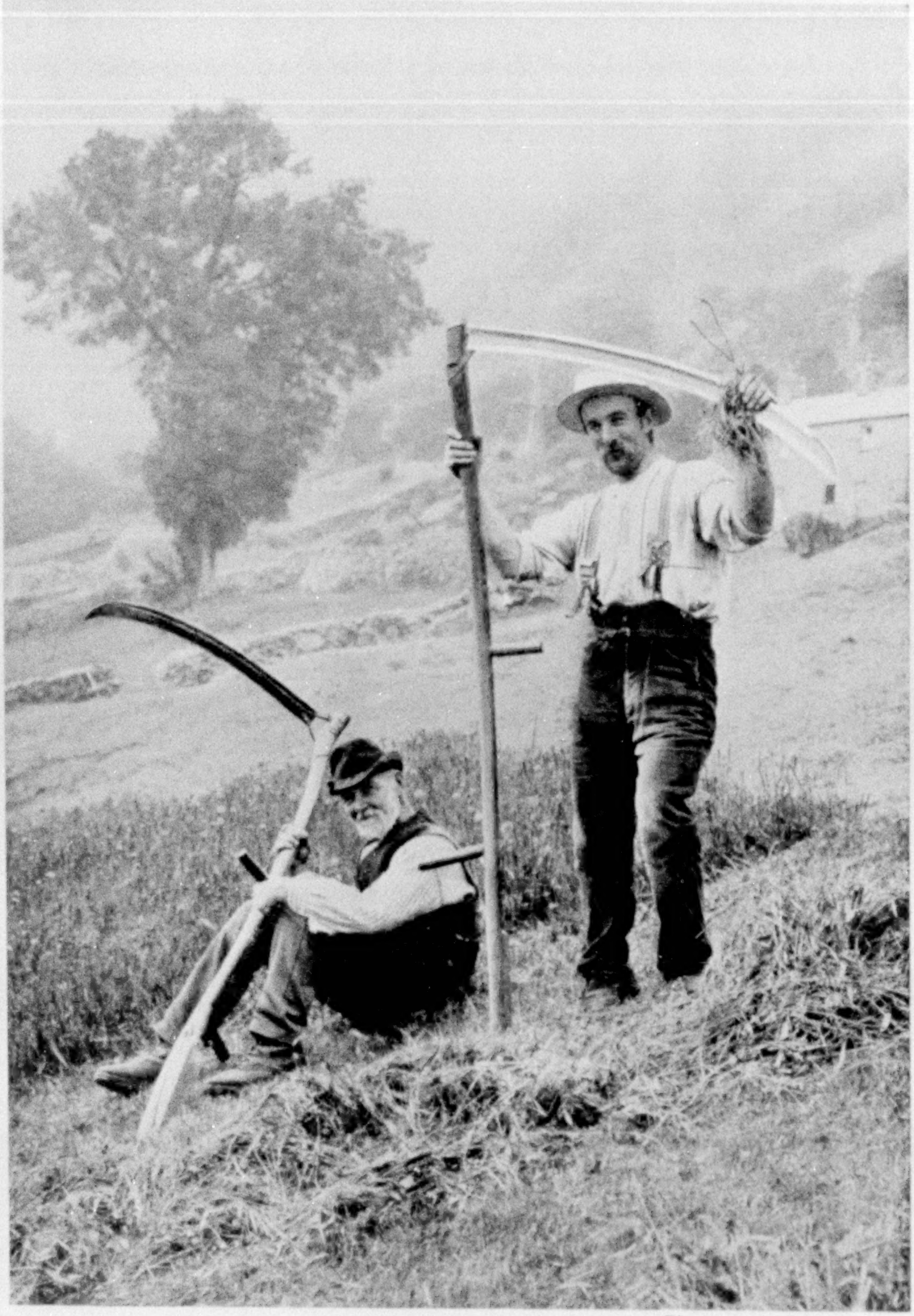
These continuous galleries or arcades occupy the place of the front rooms on the first floors of the houses on four of the main streets of the ancient city which is the gateway to Northern Wales. The ceiling of the ground floor forms the upper sidewalk (see text, page 639). The fourteenth century walls of Chester, following the lines of the ancient Roman foundations, are nearly two miles in circumference, and the paved footpath, from four to six feet wide at the top, affords a charming promenade.



Photograph by Robert Reid

THE SYCHNANT PASS, ON THE ROAD BETWEEN PENMAENMAWR AND CONWAY

The pass attains an elevation of 500 feet, almost directly from the sea. Rising from Penmaenmawr is a summit once crowned by the ancient British fort of Dinas Penmaen, immortalized by Bulwer-Lytton in "Harold, the Last of the Saxon Kings," as the scene of the betrayal of Griffith ap Llewelyn.



Photograph by Robert Reid

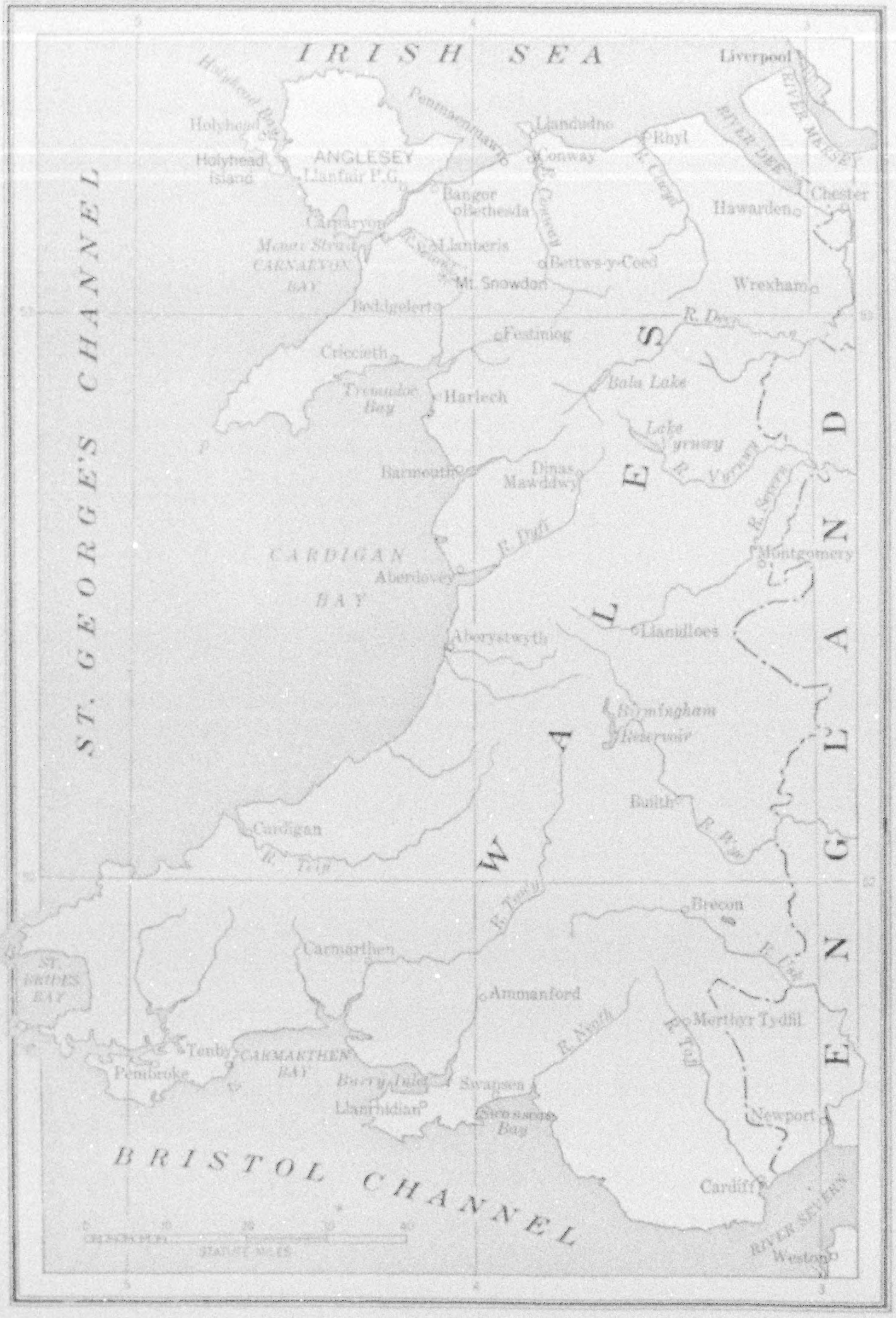
WELSH HAYMAKERS ON A HILLSIDE FARM

On the steep fields of farms in hilly districts it is impossible to use horses for mowing the hay. The younger farmer is being assisted by his father-in-law during the harvest season.

town to convince him that he must return for a longer visit.

Chicagoans might see demonstrated here in Chester how their proposed two-story sidewalks for the Loop District will work. This ancient city's famous Rows are four streets with sidewalks in two tiers. The shopper goes from store to store along a sort of open arcade, and at the end of a block, if he is on the second-story sidewalk, he descends by a stairway to the street level, crosses to the next block, and pursues his survey of show-windows (see illustration, page 636). Mystery surrounds the origin of these Rows.

Here, too, even if he has only an hour to spare, the tourist will visit the sixteenth-century "Stanley Palace"—palace only in historic associations. It was here that for sixteen weeks the seventh Earl of Derby (forebear of the present owner of the building and holder of the title) was concealed under the ceiling from Cromwell's men. But all in vain: a false servant thwarted a resourceful wife, and Stanley lost his head.


IRISH SEA
ST. GEORGE'S CHANNEL
BRISTOL CHANNEL
WALES
ENGLAND
Liverpool
RIVER MERSEY
RIVER DEE
Chester
Hawarden
Rhyl
Llandudno
Conway
Penmaenmawr
Holyhead Bay
Holyhead
Holyhead Island
ANGLESEY
Llanfair P.G.
Bangor
Bethesda
Carnarvon
Menai Strait
CARNARVON BAY
Llanberis
Mt. Snowdon
Bettws-y-Coed
Wrexham
Beddgelert
R. Dee
Festiniog
Criccieth
Tremadoc Bay
Harlech
Bala Lake
Lake Vyrnwy
R. Vyrnwy
R. Severn
Barmouth
Dinas Mawddwy
CARDIGAN BAY
Aberdovey
R. Dyfi
Montgomery
Aberystwyth
Llanidloes
Birmingham Reservoir
Builth
R. Wye
Cardigan
R. Teifi
R. Towy
Brecon
R. Usk
Carmarthen
Ammanford
ST. BRIDES BAY
Merthyr Tydfil
R. Taff
R. Neath
Tenby
Pembroke
CARMARTHEN BAY
Burry Inlet
Swansea
Llanrhidian
Swansea Bay
Newport
Cardiff
RIVER SEVERN
Weston
STATUTE MILES
0
10
20
30
40

Drawn by James M. Darley

A SKETCH MAP OF WALES

With a population of 2,206,000, the principality is 750 square miles smaller than New Jersey.

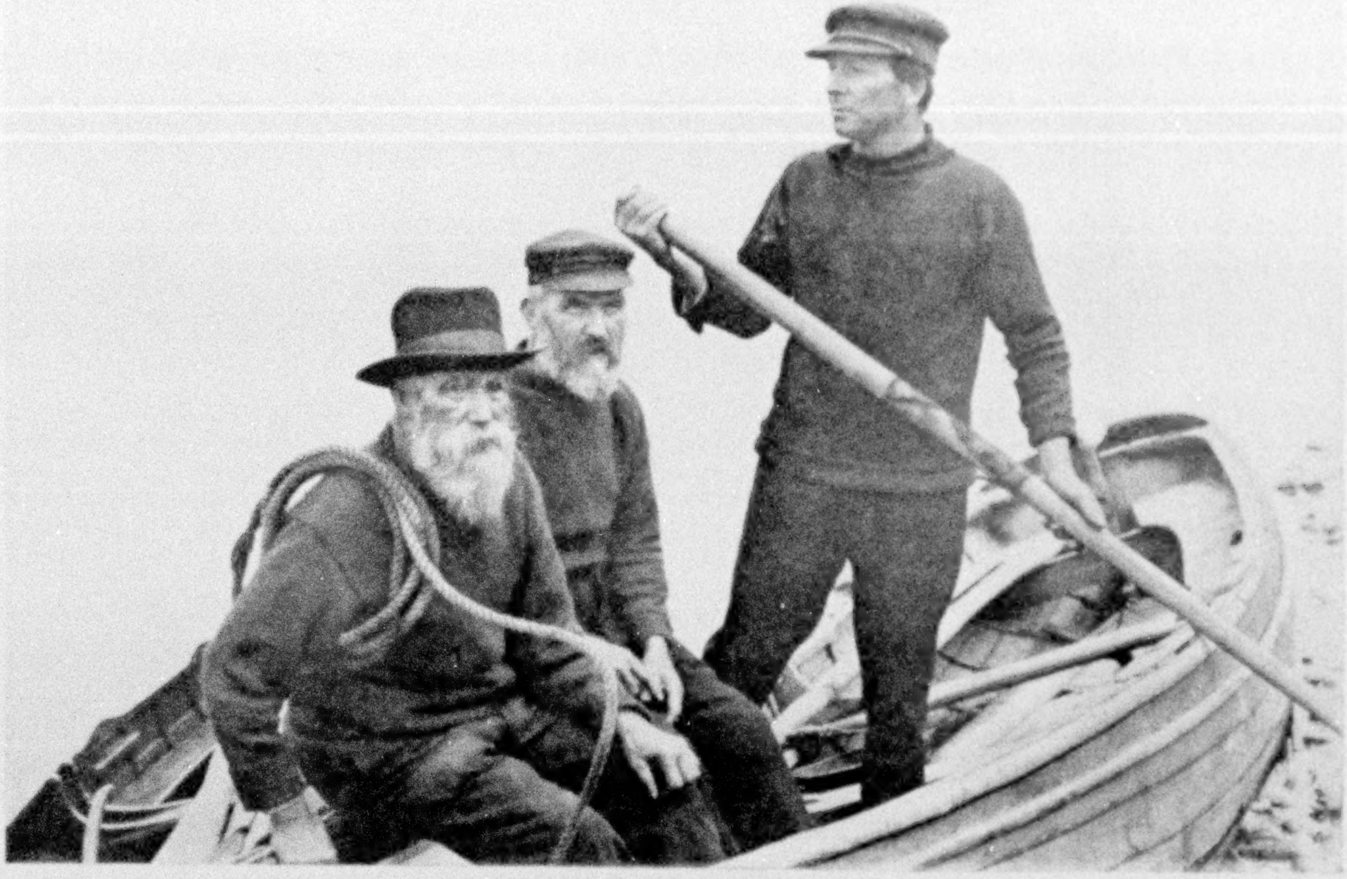
Just off the drawing-room in this quaint old structure, built thirty years before the Pilgrim Fathers reached America, are two windowless cubby-holes, where the guests were wont to sit in the glow of smoking rushlights and converse after the 9-o'clock curfew bell had sounded for all lights out.

But, regardless of Chester's compelling charm, we cannot linger on the threshold of Wales if we would enjoy its hospitality.

GLADSTONE'S HOME AND THE SANDS OF DEE

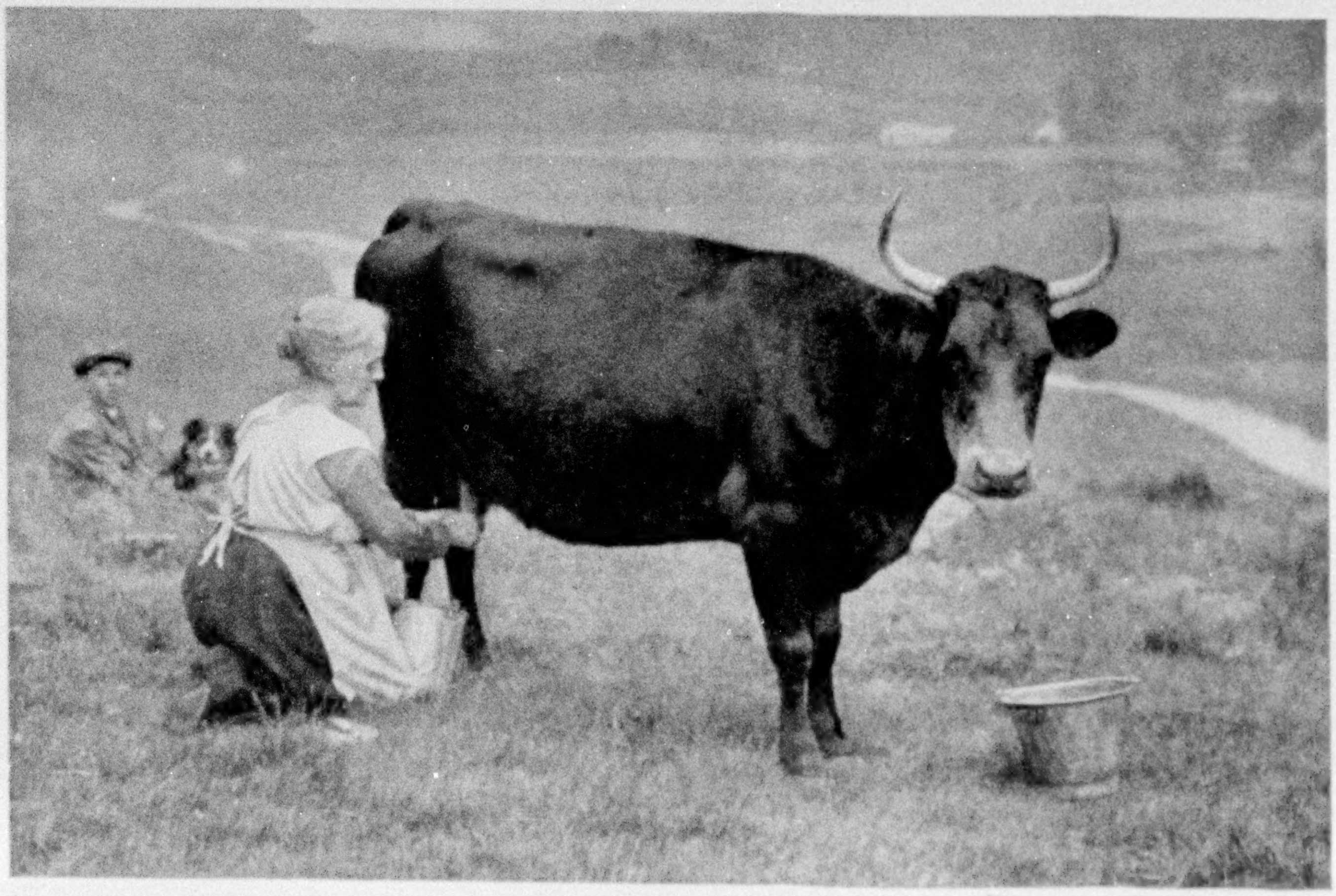
Crossing the River Dee, our train enters Wales, bound for Carnarvon, 69 miles distant by way of Rhyl, Conway, and Bangor.

Within a mile or two of the railway line, and just six miles southwest of Chester, rises Hawarden Castle, famous in Welsh history and as the residence of



FISHERMEN OF CONWAY

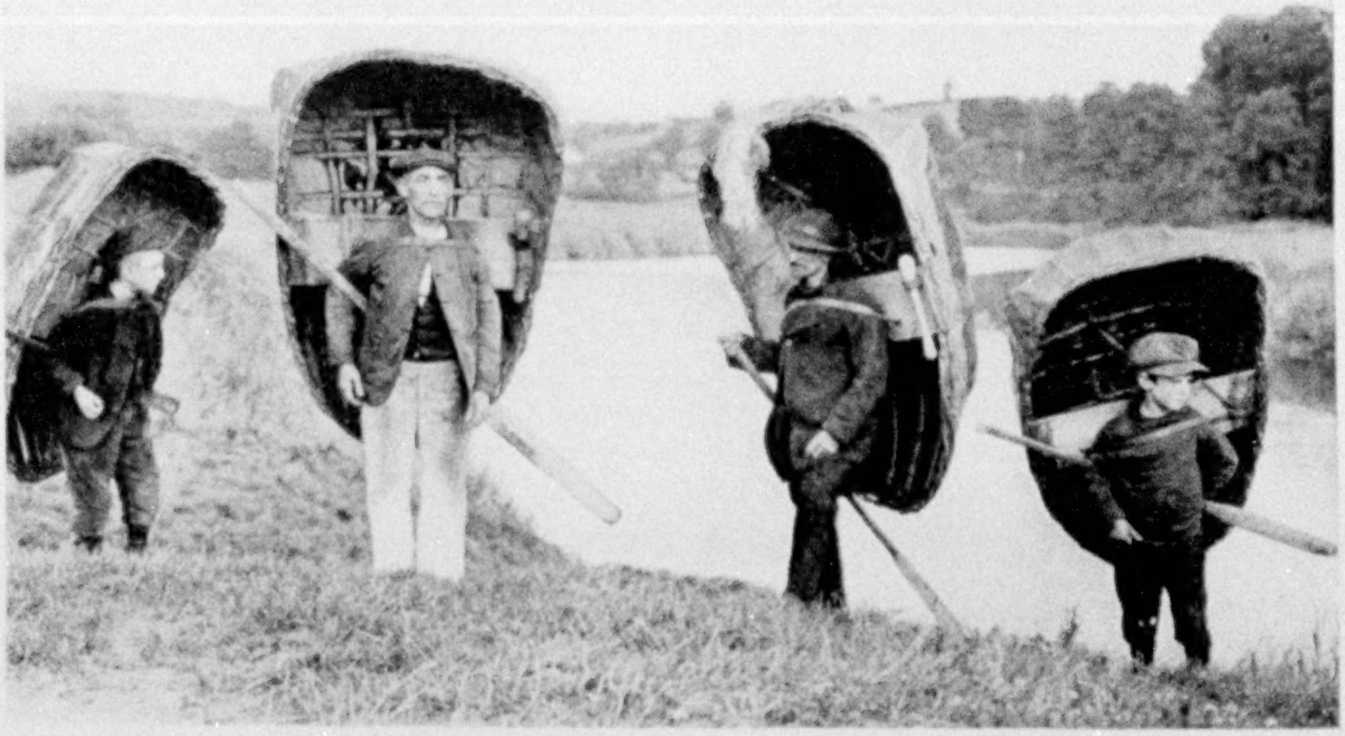
During the summer season fishermen augment their incomes by renting small pleasure boats to visitors. At one time Conway was famous for its pearl fisheries, which are mentioned in Spenser's "Faerie Queene," and one of the Conway pearls is said to be in the British Crown.



Photographs by Robert Reid

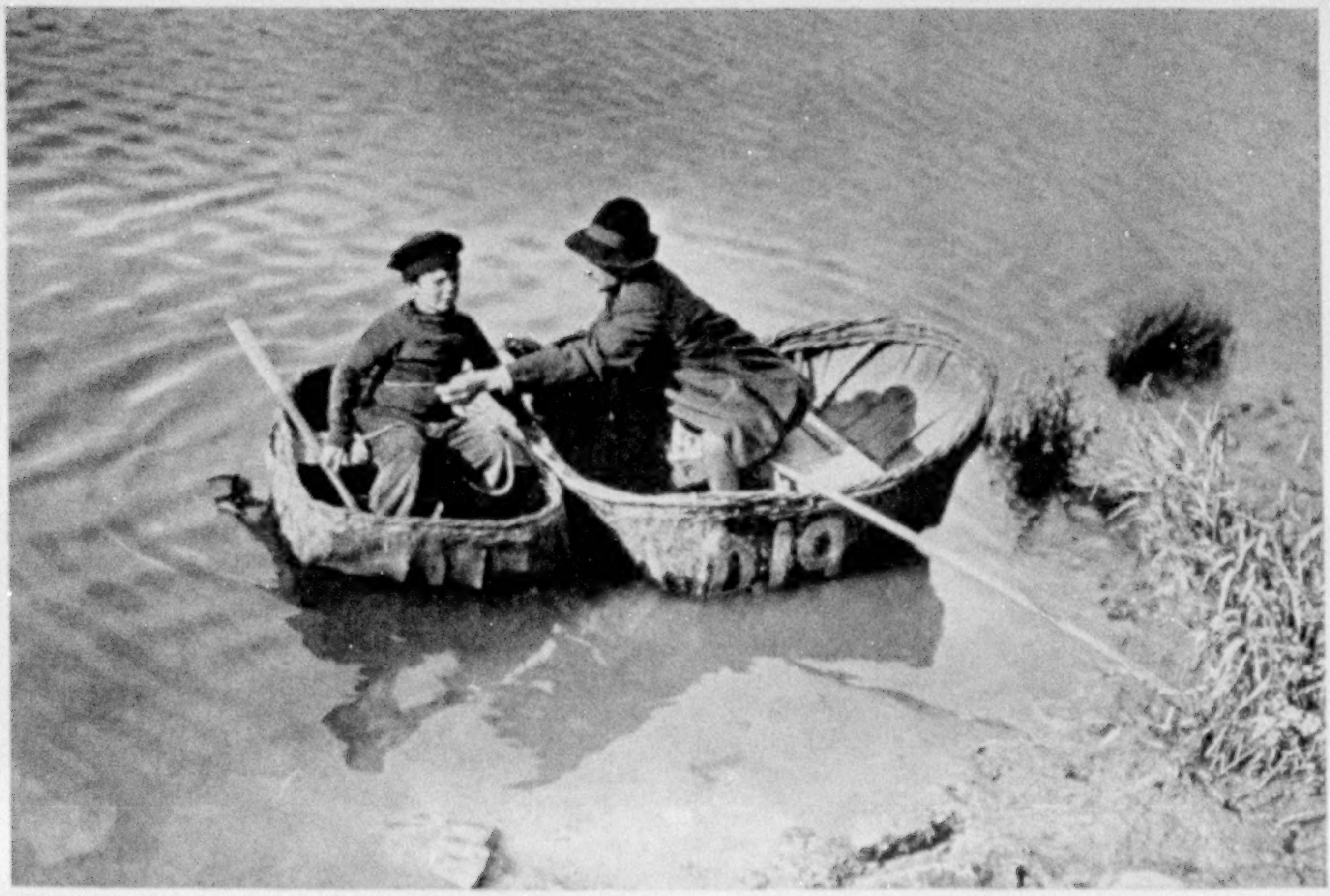
MILKING TIME: WALES IS FAMOUS FOR ITS BLACK CATTLE

The great herds of goats which in medieval times swarmed on the Welsh hills have given way to the small mountain sheep which produce the excellent Welsh mutton.



SALMON FISHERMEN AND THEIR CORACLES ON THE BANKS OF THE RIVER TOWY

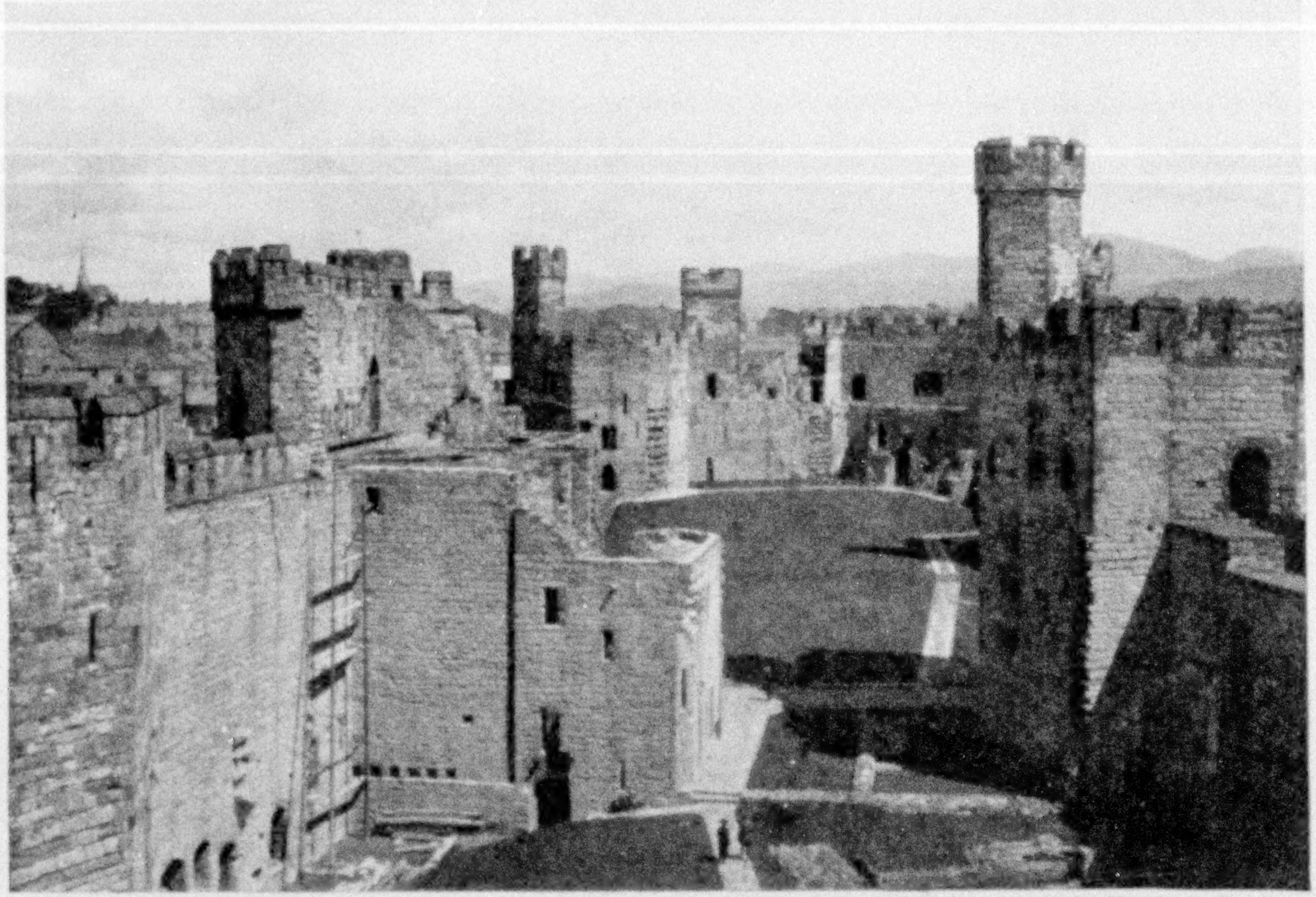
This type of boat is a survival of the skin-covered coracle used by the Britons 2,000 years ago. The frame, of beech and ash twigs interlaced, is covered with a stout sheet of canvas soaked in tar and pitch. Note the clubs in leather pockets on the seats, used for killing salmon when caught.



Photographs by A. W. Cutler

TAKING HIS FIRST LESSON IN THE NAVIGATION OF A CORACLE

Until a boy has become proficient in the art of handling this ancient craft of Wales, he is tied to it with a rope, so that if the boat turns turtle he can hang on to it till assistance arrives.



Photograph by Ralph A. Graves

THE INTERIOR OF CARNARVON CASTLE AS SEEN FROM THE EAGLE TOWER

It was in a small room of the Eagle Tower that Edward II, the first English Prince of Wales, is reputed to have been born (see text, page 644). The present heir to the British throne was invested here, with great historic ceremony, in 1911.

Queen Victoria's great "Home Rule" premier, Gladstone.

On our right hand, for many miles stretch those fatal Sands of Dee across which Charles Kingsley's Mary went to "call the cattle home," and never home came she.

We shall not stop at Rhyl, the first considerable Welsh seaside resort. It has its attractive marine drive and promenade, its pavilions and its piers—the sort of diversions demanded by its 100,000 annual visitors—but nothing of special interest to commend it over any of a score of our own watering places.

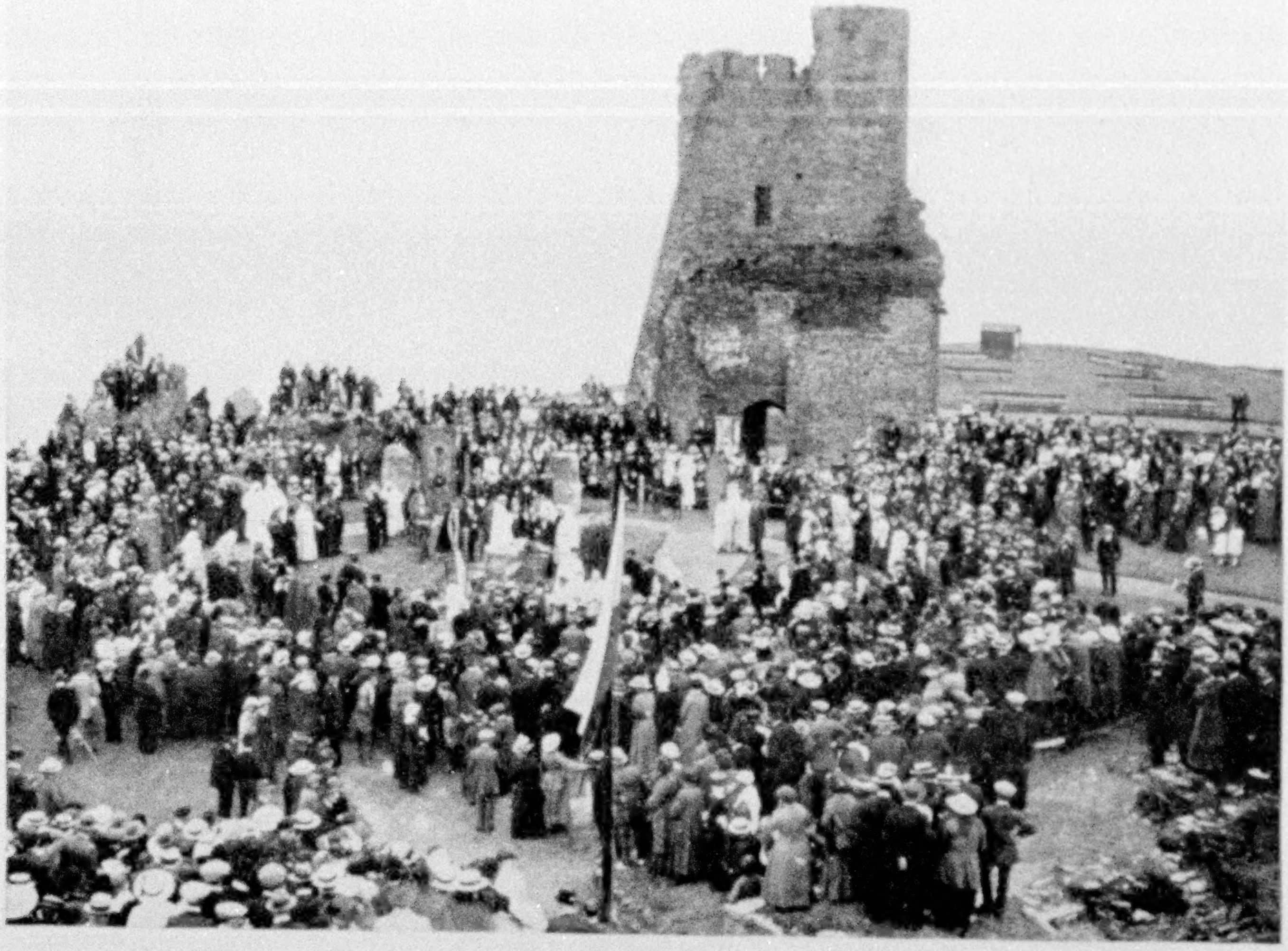
Nor shall we stop just now at Conway. Let us hold that in reserve for a Monday-morning visit, after our quiet Sunday in Llandudno, on our return journey.

Loyal Welshmen will look upon it as an affront if we fail to leave the train at Bangor and pay a hurried visit to their famous suspension bridge over the Menai Strait, "a marvel of strength and elegance," with a length of 580 feet from pier to pier and 1,710 feet over all from the mainland to the island of Anglesey. It must be admitted that this structure is surpassed by the Brooklyn Bridge, the suspension bridge across the Danube at Budapest, and others; but when it was opened, a hundred years ago, it was regarded as a notable engineering triumph, materially reducing the time between Dublin and London via coach and fast packet, and obviating the crossing of the Strait by ferry—a perilous undertaking at certain tides.

There is a second bridge across the Menai Strait now—the Britannia tubular bridge, which accommodates the express trains running to Holyhead, port for mail steamers to Dublin, only 60 miles across St. George's Channel.

CARNARVON, MOST HISTORIC TOWN OF WALES

Resuming our journey after reading the warning sign that "Persons are prohibited from joining trains without first obtaining tickets", we arrive late in the afternoon at Carnarvon, a community



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THE GORSEDD CIRCLE, IN THE CASTLE GROUNDS AT ABERYSTWYTH

The Eisteddfod (see text, page 644) is opened by ceremonies of the Gorsedd, within the Bardic Circle, according to ancient custom. Aberystwyth, often called the Brighton of Wales, is the most important resort on Cardigan Bay. It is the home of the National Library and the seat of the senior college of the University of Wales, the other constituent colleges being located at Bangor and Cardiff.

which concentrates more history in smaller space than any other town in Wales.

Depositing our baggage at a low-spreading hotel, once a coaching inn, near the station, and receiving from the proprietor a tiny motor guidebook which gives the grade, mile by mile, of all the highways of Northern Wales, we meander up the main street in the direction indicated by an obliging Carnarvonite.

Turning a corner, we are suddenly face to face with one of the finest castles in Great Britain. Built entirely of hewn stone, the imposing structure stands on the peninsula formed where the River Seiont flows into the Menai Strait.

Every room in the great building has its legend, each dear to the stentorian guide, whose indignant protest to an incredulous tourist greets us down the full length of the corridor which once gave entrance to the noble banquet hall 100 feet long and 45 feet wide.

LEGENDARY BIRTHPLACE OF FIRST ENGLISH PRINCE OF WALES

There are those who would take the "Oh!" out of all history, leaving it devoid of color and sentiment. They have been busy with Carnarvon Castle, trying to rob it of its most cherished tradition; but, since the present bearer of the title thought there was sufficient basis for the story to warrant his investiture in this castle in 1911, we shall prefer to accept the legend that here was born the first English Prince of Wales, 639 years ago.

The story is a familiar one.

During the reign of Edward I, the Welsh rose against the English, declaring that they would never acknowledge

XUM

allegiance to any prince "but of their own nation and language and of an unblamable life."

Edward brought his army to Wales and put down the rebellion led by Llewelyn the Last. He then commissioned his famous architect, Henry de Elreton, to build castles at Conway, Carnarvon, Criccieth, and Harlech, as strongholds from which in future he might hold his turbulent subjects in check.

During his long stay in Wales, Edward's queen, Eleanor, visited him at Carnarvon, and in a small room, barely twelve by eight feet, in the so-called Eagle Tower of the unfinished castle, he who was to be Edward II was born.

Tradition further says that the king, half in jest and half in earnest, presented the baby to the Welsh people as "a native-born prince of unblamable life who could speak no word of English." A few years later (1301) this son was formally created "Prince of Wales," and from that day to this the recognized heir to the English throne has borne that title.

One of the dungeons shown to the visitor is that in which the notorious Roundhead, William Prynne, was confined, having been sentenced to "lose the *remainder* of his ears, to be branded on the cheeks, pay a fine of £5,000, and be imprisoned in Carnarvon Castle for life."

From the towers of this stronghold, which one historian declares was built within a year by the forced labor of Welsh peasants and with money wrung from the country's chieftains, we can survey the scenes of many of the most stirring episodes of Welsh history — a panorama of two thousand years, from the time when Roman legions occupied the site as the city of Segontium to the present day, symbolized by a bronze statue of David Lloyd George standing in the shadow of the castle walls.

Incidentally, it is Carnarvon that has returned Lloyd George to Parliament for more than thirty years, and he enjoys the honorary distinction of being Constable of the castle. The War Premier's home is not in this town, however, but in Criccieth, 15 miles to the south. Contrary to popular belief, the Welsh statesman was born neither in Carnarvon nor Criccieth, but in Birmingham, over on the English side, where his parents were residing at the time, his father being a school-teacher. He spent his childhood and youth, however, in "the little land behind the hills," as he has characterized his country.

THE EISTEDDFODAU, MOST DISTINCTIVE OF WELSH FESTIVALS

A short distance from the castle is Twt Hill, below which is an immense pavilion capable of seating 8,000 persons, and yet its capacity is greatly overtaxed whenever an Eisteddfod is held in Carnarvon.

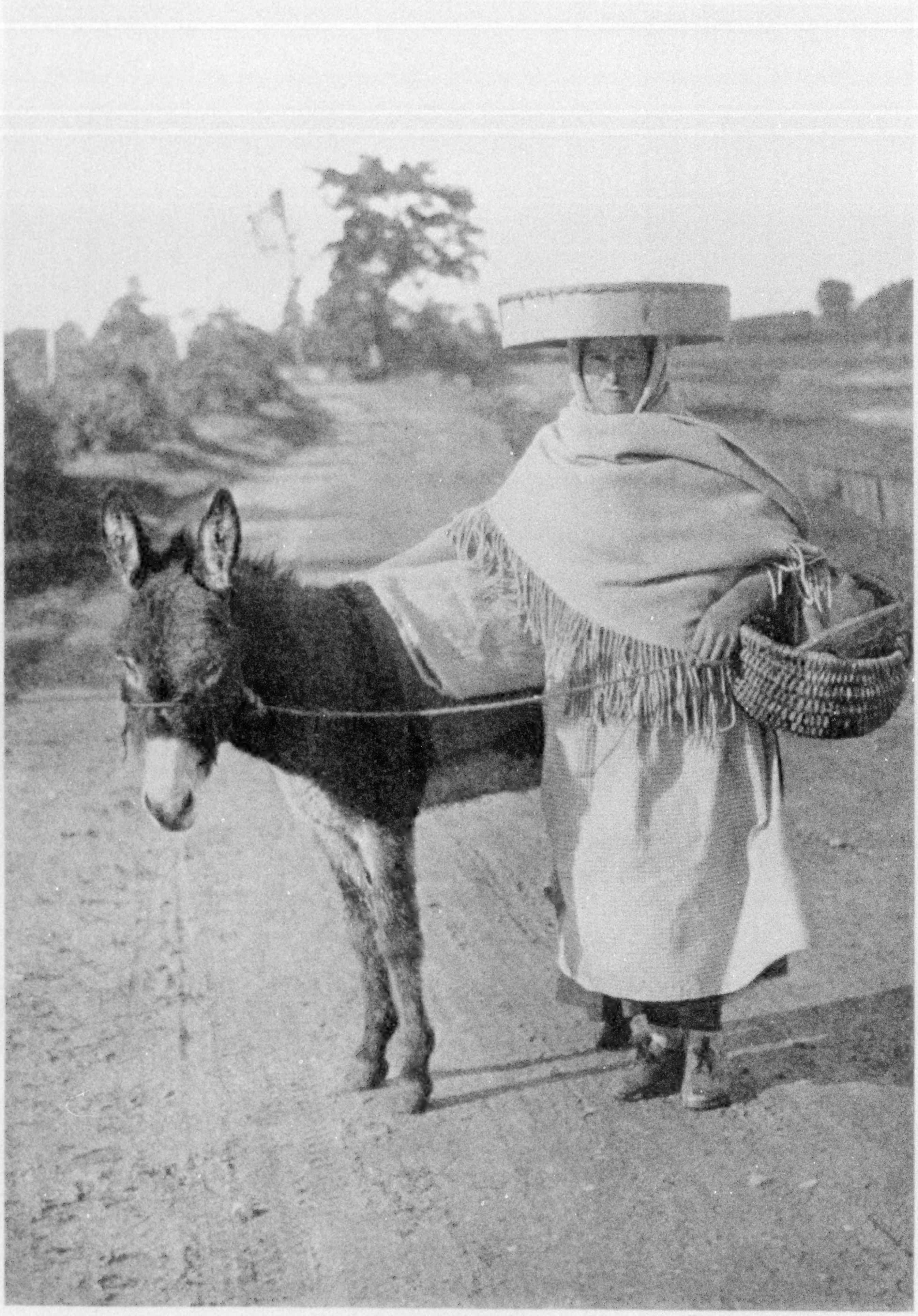
The Eisteddfodau are among the most distinctive and inspiring institutions preserved for sixteen hundred years by the Welsh. They are the famous festivals of song, music, and poetry where Welsh bards participate in contests comparable only to those of the ancient Greeks, except that here the competition is exclusively intellectual and artistic, with no place for athletics on the program.

The national Eisteddfod has been held annually since 1819, in Northern Wales and Southern Wales alternately.

A pretty story has survived concerning an Eisteddfod held in the sixth century, on the banks of the Conway, when a prince of Northern Wales, in order to prove the superiority of vocal music over instrumental, offered a prize to the contestants who would swim across the river and then compete. Those bards who had harps found their strings wet when they reached the scene of the competition, but the vocalists were in perfect form and won easily.

One of the spectacular feats at an Eisteddfod is the "pennillion" singing, in which the poets compose their songs after the harpist has begun his melody. Each poet in turn sings his verse, beginning two measures behind the harpist, but ending on the same measure. The contestant who is able to improvise worthy verses longest wins one of the most cherished honors of the festival.

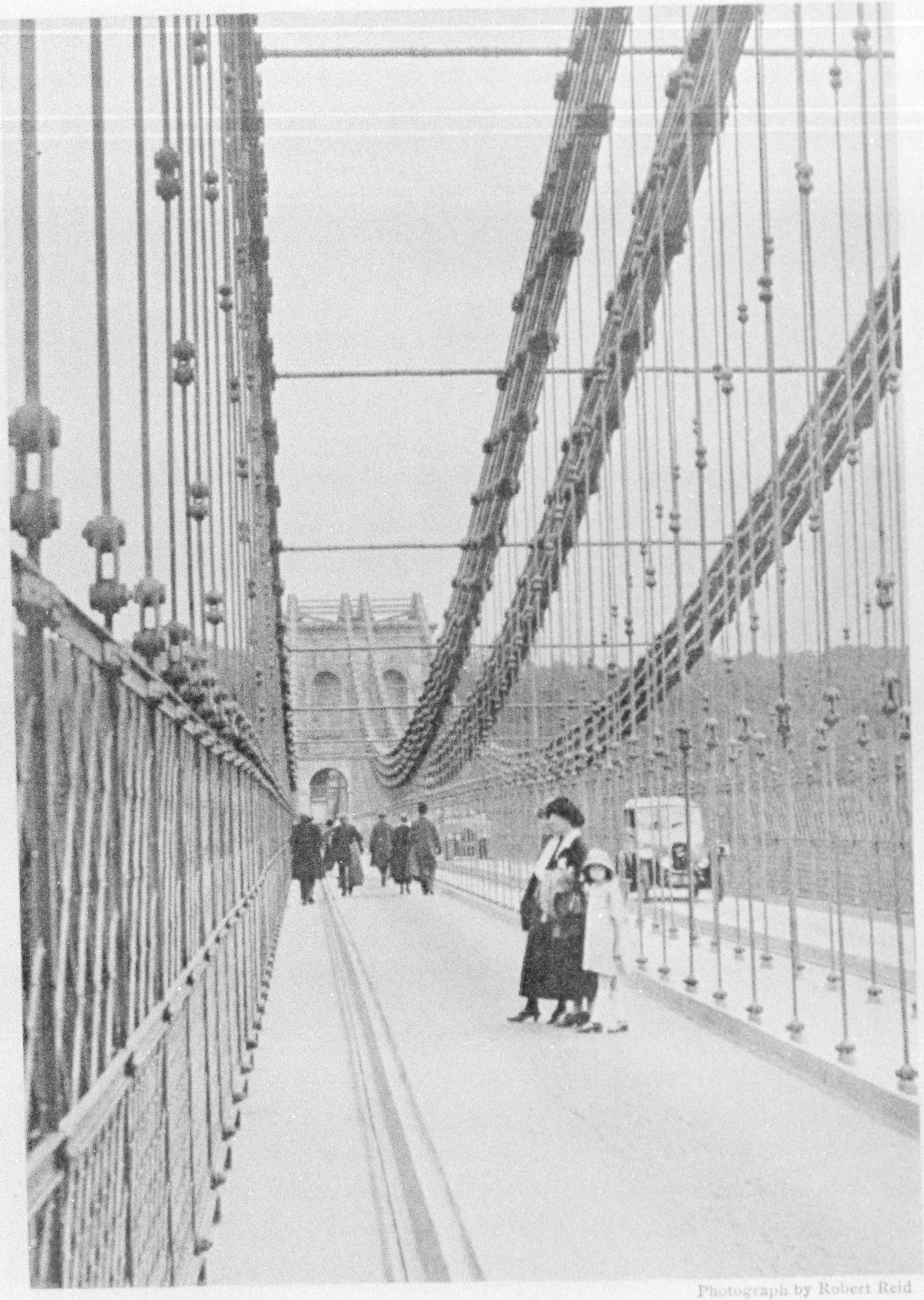
Such contests have made the Welsh a nation of singers, and the rivalry between the various sections is such that even underground the coal miners are said to rehearse their choruses for the coming Eisteddfod. And Dr. Daniel Protheroe, of Chicago (born in Ystradgynlais), the Welsh composer and conductor, is authority for the statement that immediately after the Armistice, when the Allies were



Photograph by Robert Reid

ON HER WAY TO THE COCKLE SANDS

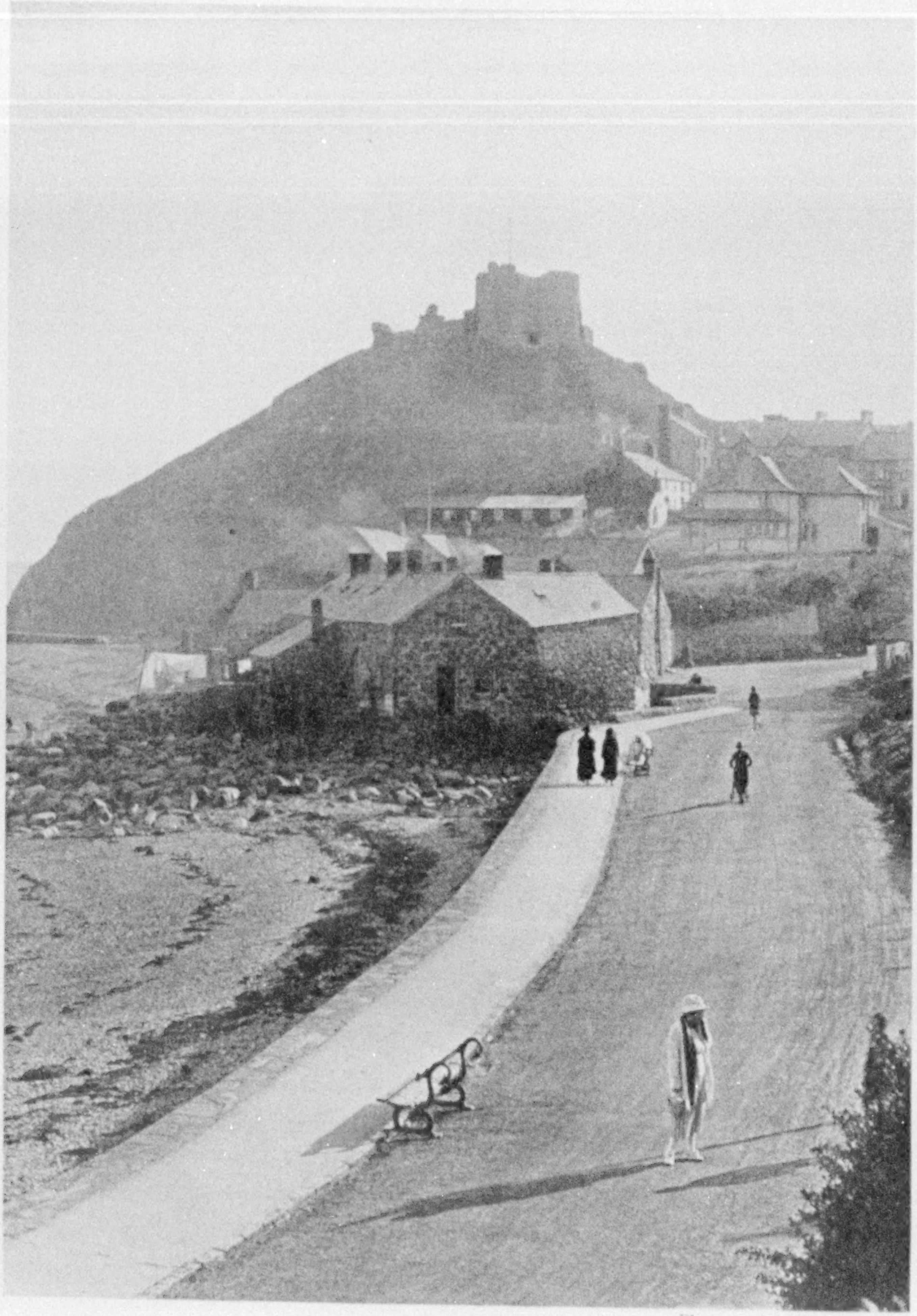
The women carry their riddles (used in separating the shellfish from the sand) on their heads, sometimes walking alongside the donkeys and sometimes riding on them. The donkeys have no bridles and only a sack for a saddle.



Photograph by Robert Reid

MENAI SUSPENSION BRIDGE, ONCE A MARVEL OF ENGINEERING

There are two carriageways, each 12 feet wide, and a footpath between them, 4 feet wide. The total length of the bridge is 1,710 feet and the distance between the points of suspension is 580 feet (see text, page 642).

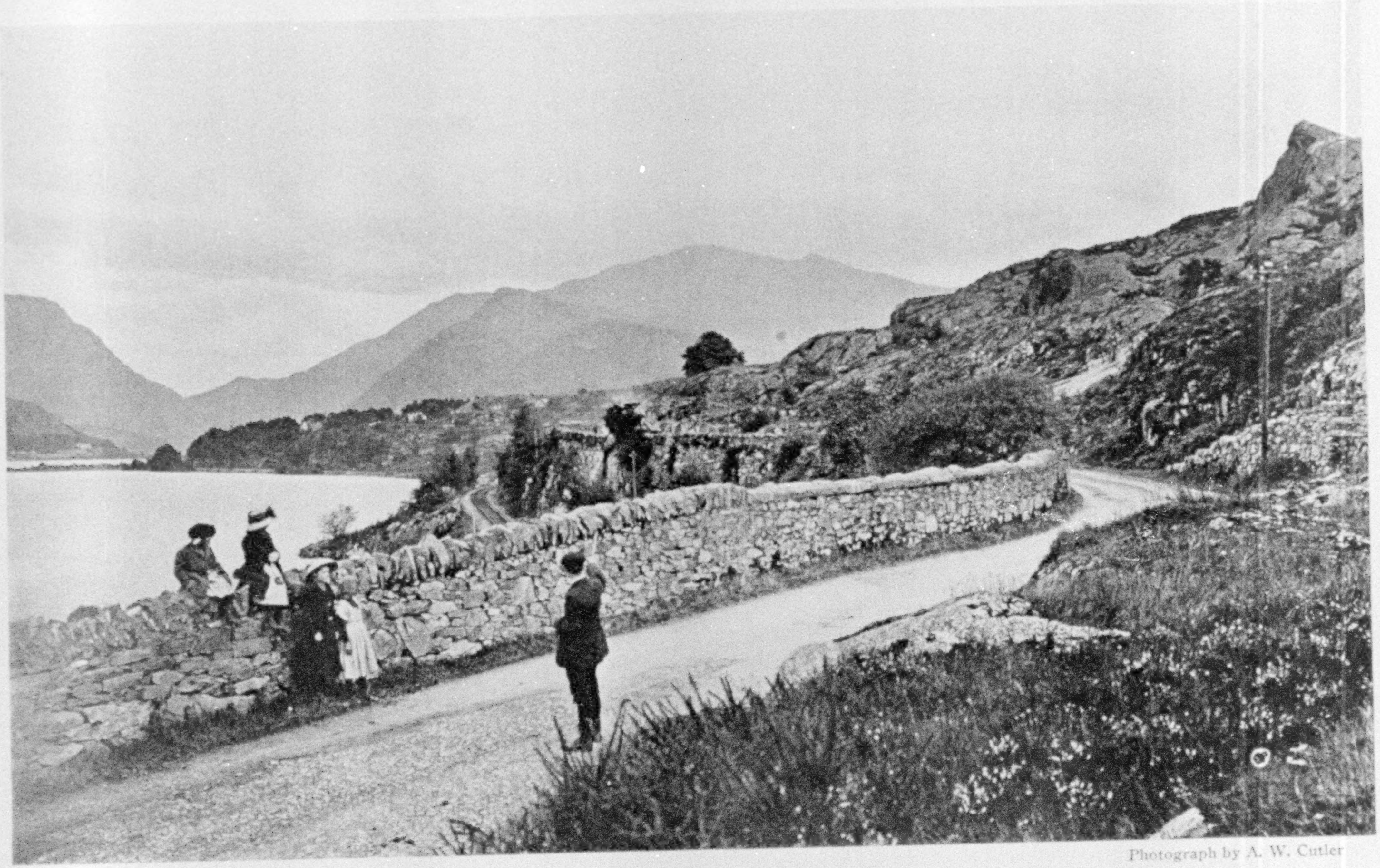


Photograph by Robert Reid

THE CASTLE OF CRICCIETH, BUILT ON A HIGH ROCK JUTTING OUT INTO THE SEA

Criccieth, on the southern slope of the Carnarvonshire Peninsula, commands a splendid view of Cardigan Bay and has a fine stretch of sandy beach. On a hill to the north of the main street of the town is Bryn Awelon, a modern timbered house, the residence of David Lloyd George.

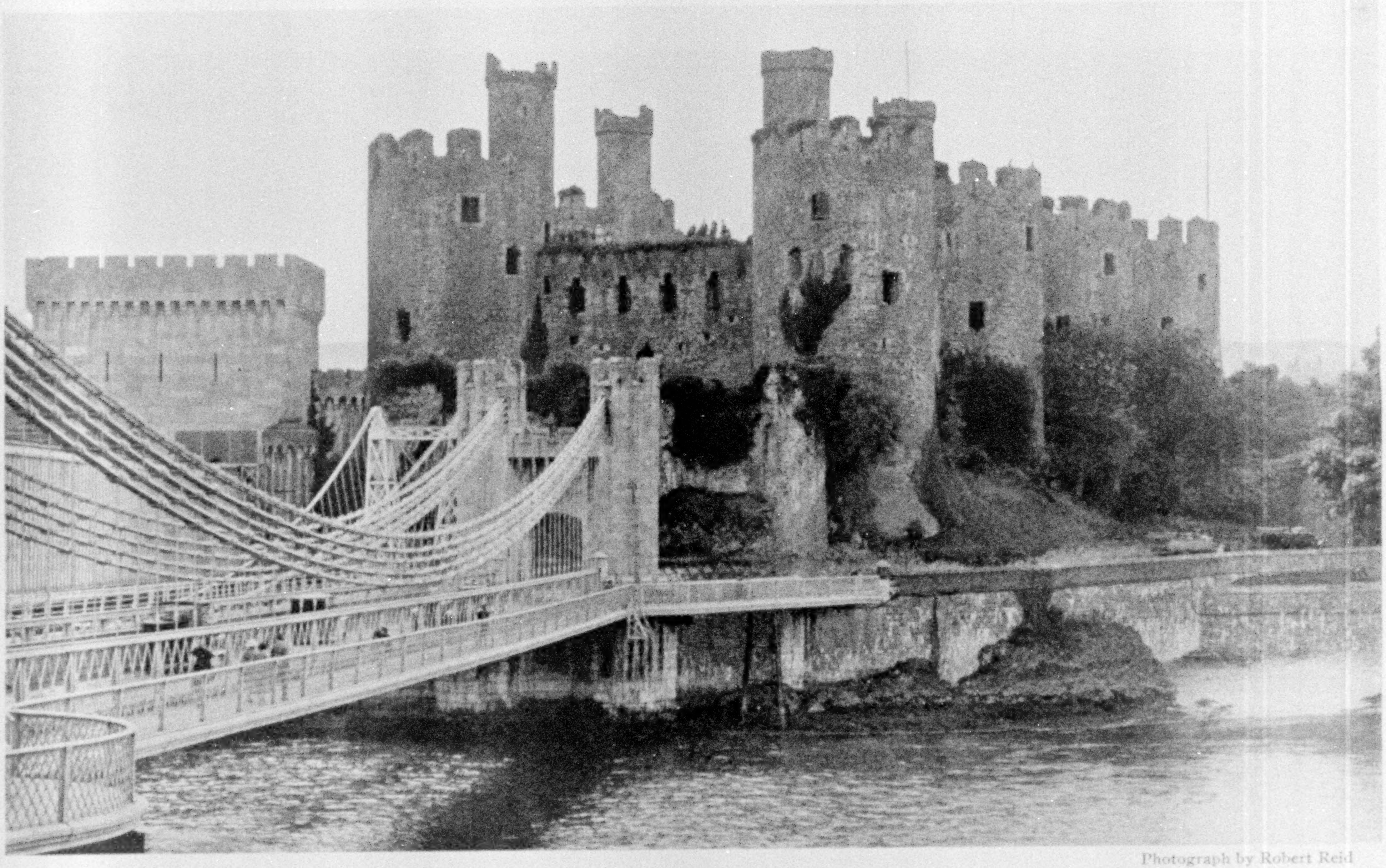
XUM



Photograph by A. W. Cutler

MOUNT SNOWDON, THE MOST DISTANT PEAK ON THE RIGHT, SEEN FROM LLANBERIS

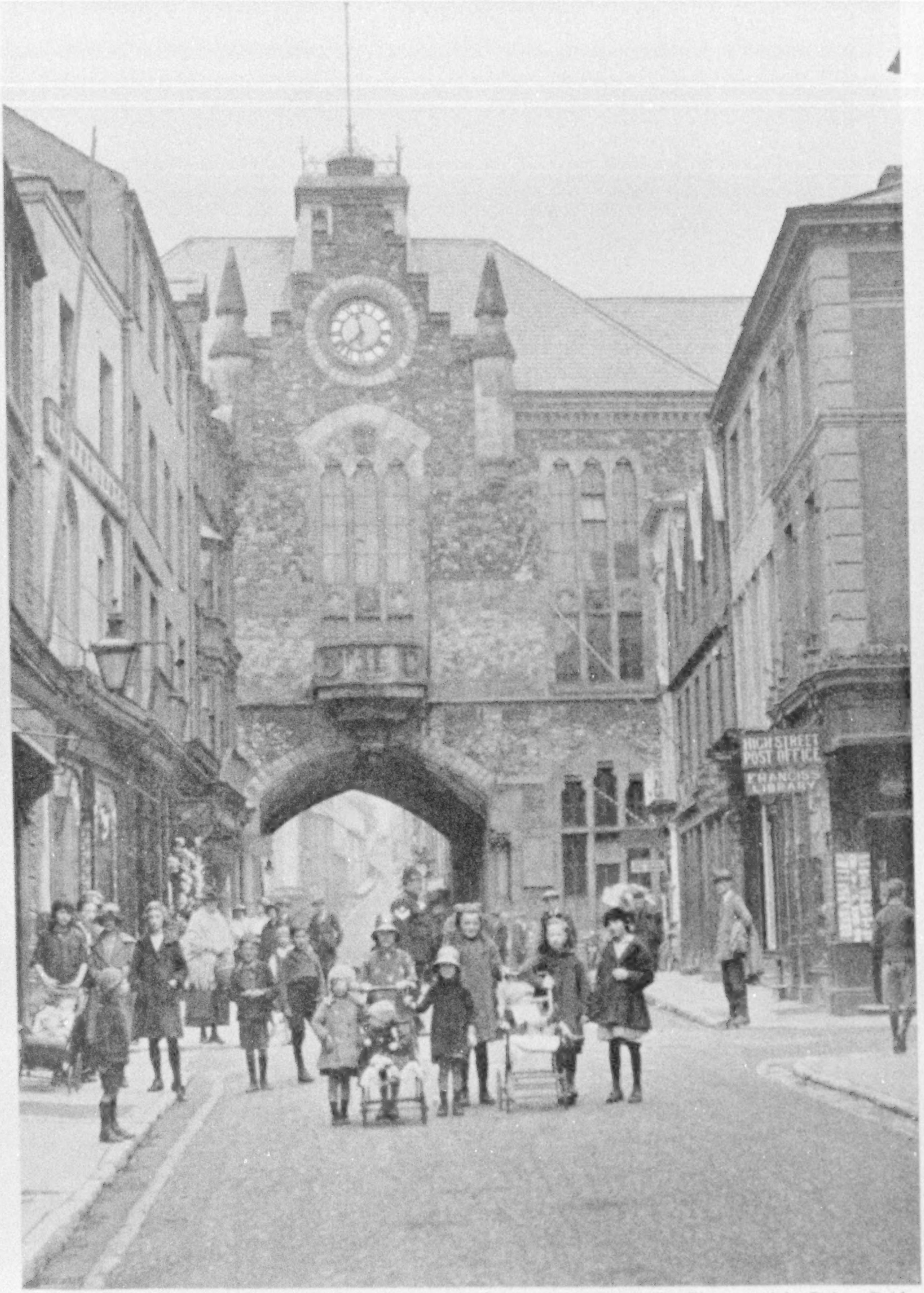
Through the near-by Pass of Llanberis runs the finest carriage mountain road in Wales. The water to the left of the picture is Llanberis Lake.



Photograph by Robert Reid

CONWAY CASTLE AND THE SUSPENSION BRIDGE OVER THE CONWAY RIVER

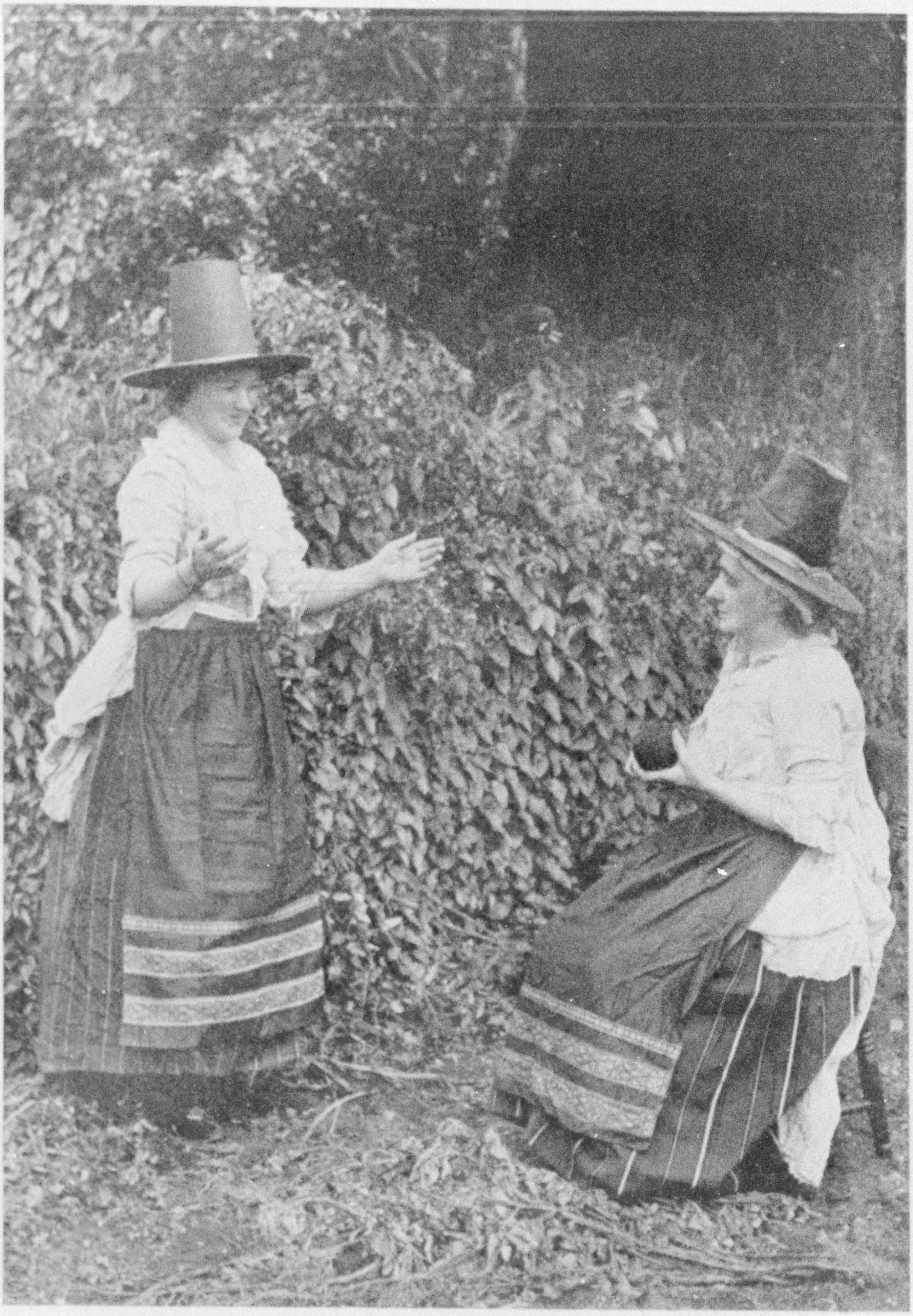
The town of Conway is surrounded by a high wall 12 feet thick and fully a mile in circumference. The wall is pierced by four gates of Moorish aspect and is crowned by 21 towers. In its southeastern corner are the magnificent remains of Conway Castle (see text, page 666). The walls are from 12 to 15 feet thick, with eight large towers, on four of which are turrets. There were two entrances to the castle—one by a narrow flight of steps leading to the river, and the other, the main entrance, by a drawbridge over a deep moat.



Photograph by Robert Reid

EAST GATE AND GUILDHALL, CARNARVON, CAPITAL OF NORTHERN WALES

The town is the center of a large agricultural district. Some of the streets are very narrow and quaint, reminding one of medieval times. Large numbers of motor busses ply from the castle square to the foot of Mount Snowdon, and also to the surrounding villages. The ancient walls of the town, flanked with round towers, are well preserved.



Photograph by Robert Reid

TWO WOMEN IN WELSH COSTUME WINDING YARN IN A GARDEN AT CARNARVON

The national costume is seldom seen nowadays, except at the great festivals of song and poetry—the Eisteddfodau (see text, page 644); but the old language and the folk tales, many generations old, are sedulously preserved in the Welsh hills and remote valleys. For the women who cling to ancient fashions there are special hatters to make the tall, glossy beavers.

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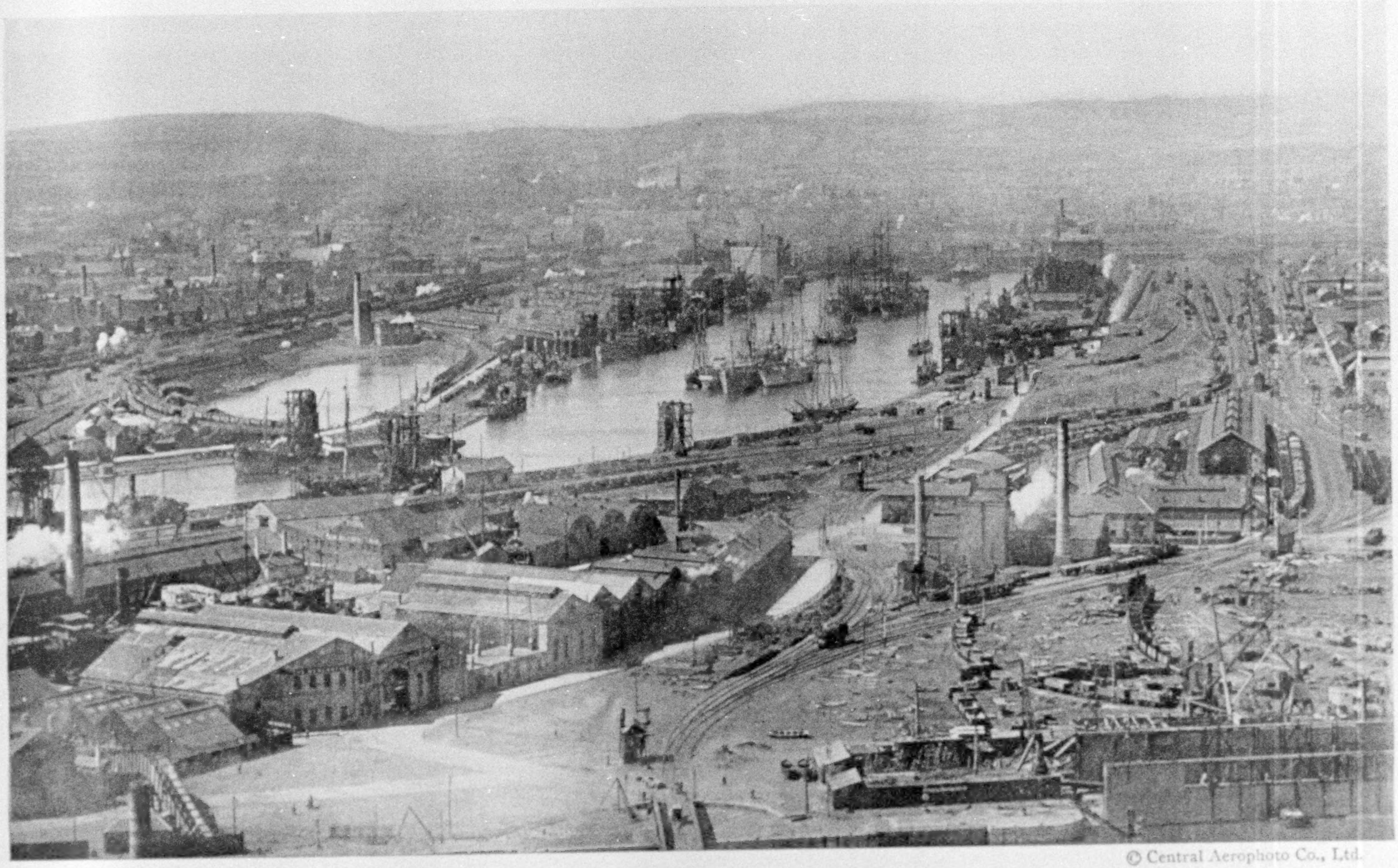

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AN AIRPLANE VIEW OF CARDIFF, THE METROPOLIS OF WALES

Cardiff's growth from a village of less than 2,000 inhabitants in 1801 to a city of 200,000 is due to its geographical position, as the natural outlet for the South Wales coal field. To-day it is the largest coal-exporting port in the world.

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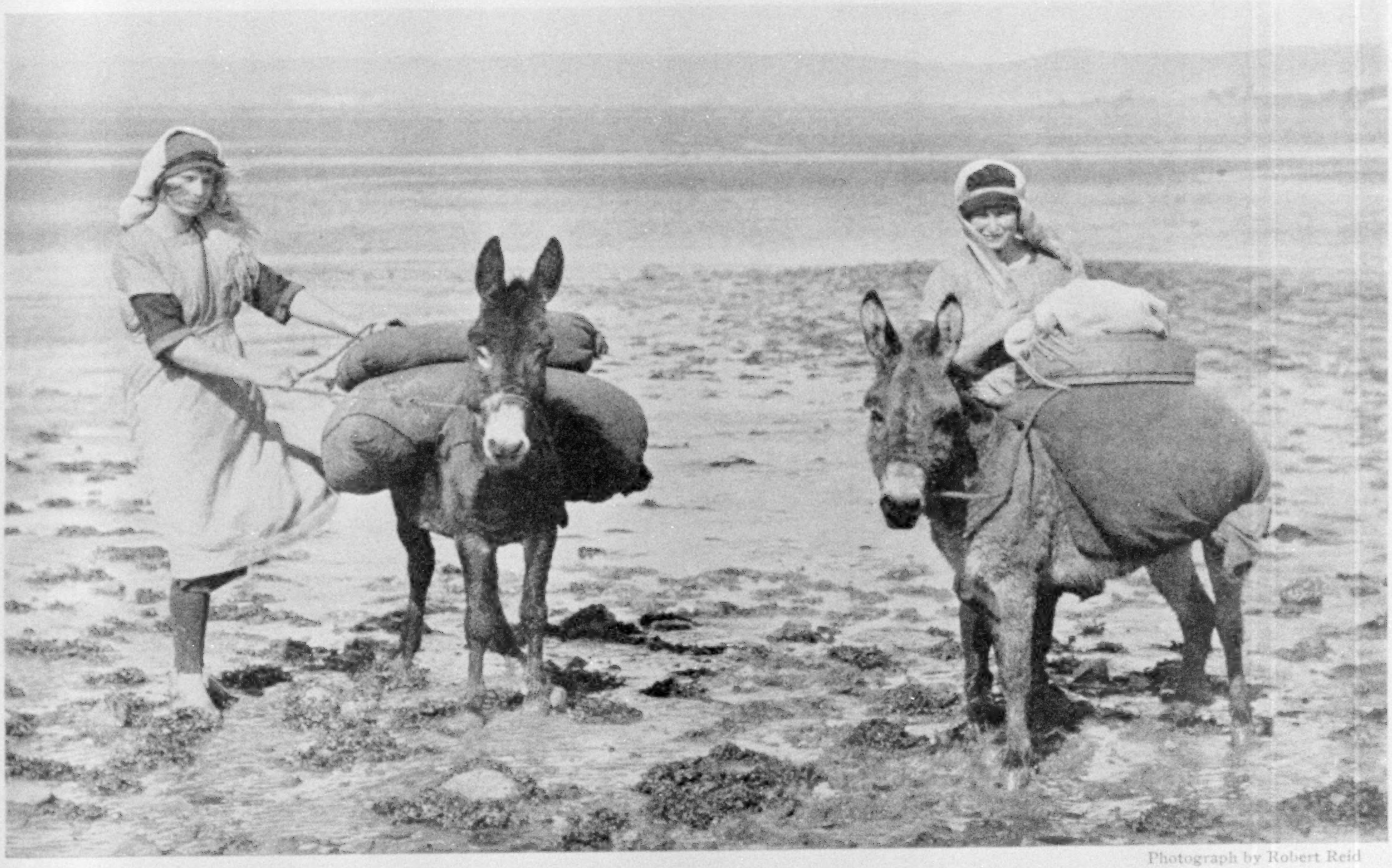
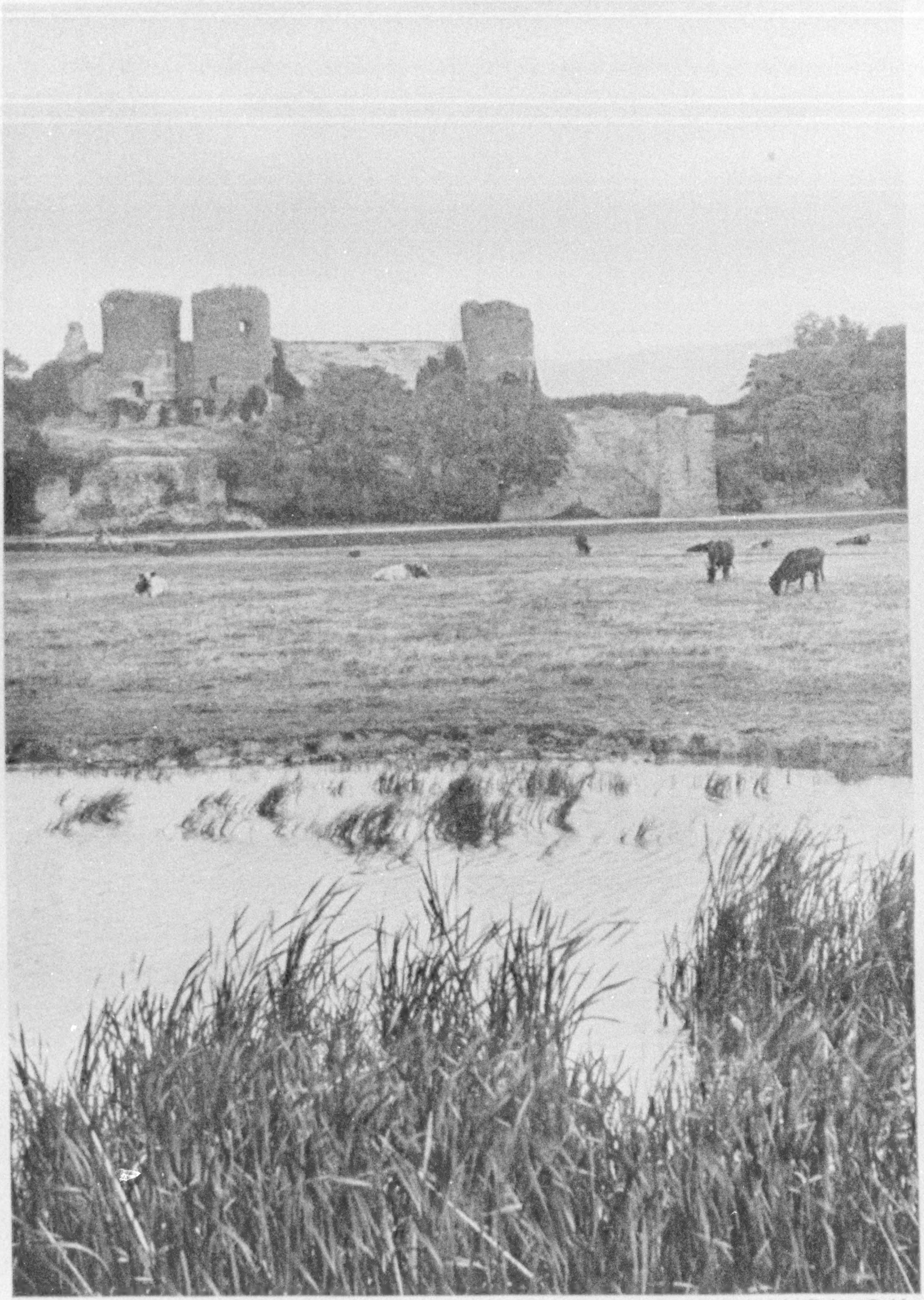


Photograph by Robert Reid

COCKLE GATHERERS

The donkeys are most willing workers. The road between Llanrhidian, South Wales, and Llanmorlais, a village to the northeast, runs through what is known as Cockleland, as attested by the mounds of cockle shells and the women at work gathering the edible shellfish, which are taken in great quantities from the estuary of the Burry River.



Photograph by Robert Reid

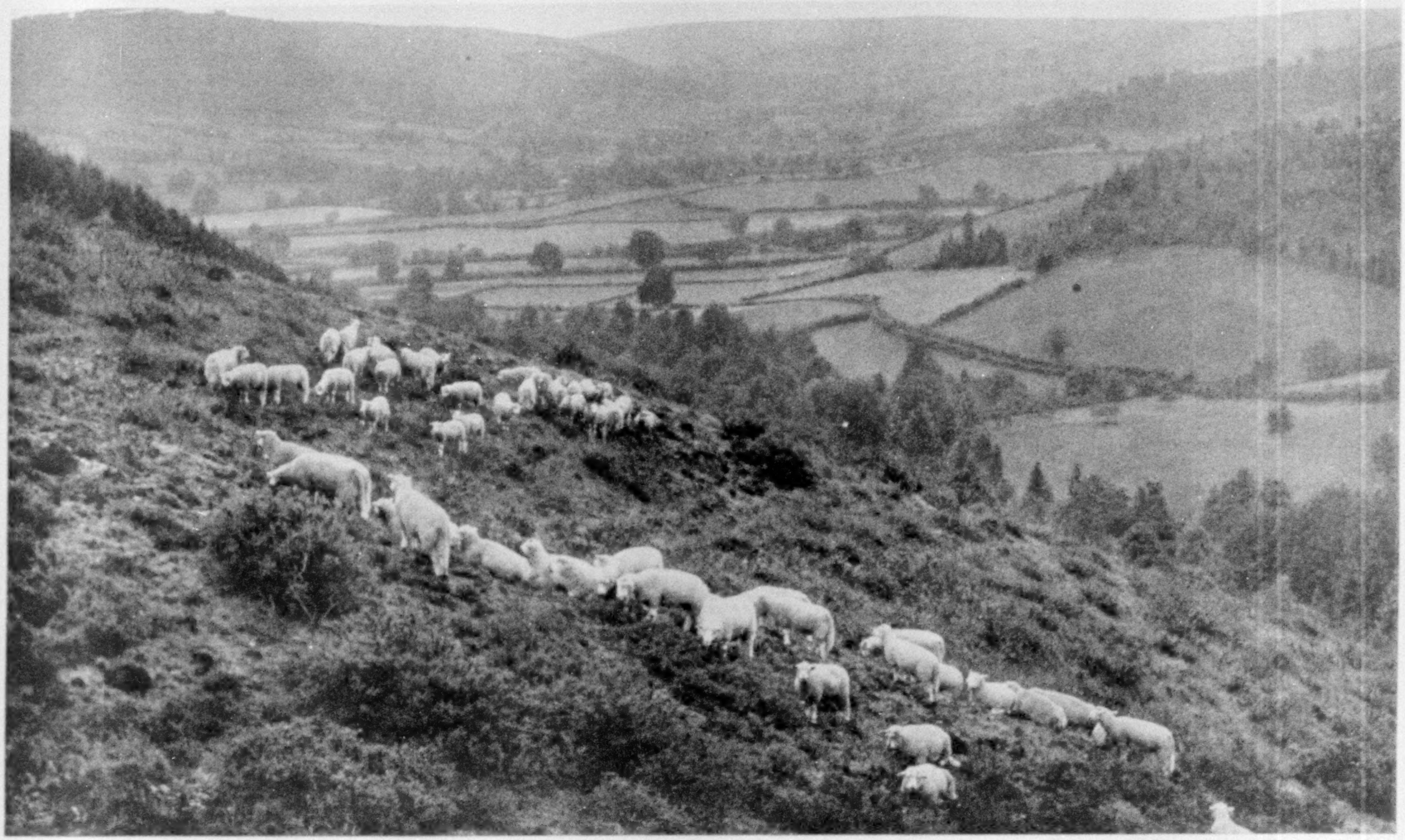
RHUDDLAN CASTLE, THREE MILES INLAND FROM RHYL

This stronghold was built by a prince of Northern Wales early in the eleventh century, and was rebuilt by Edward I in 1277. It was here that the English king succeeded in inducing the Welsh chieftains to accept as their prince the baby born in Carnarvon Castle (see text, page 644).

Photograph by A. W. Cutler

THE OPENING OF THE WADING SEASON AT TENBY, SOUTH WALES

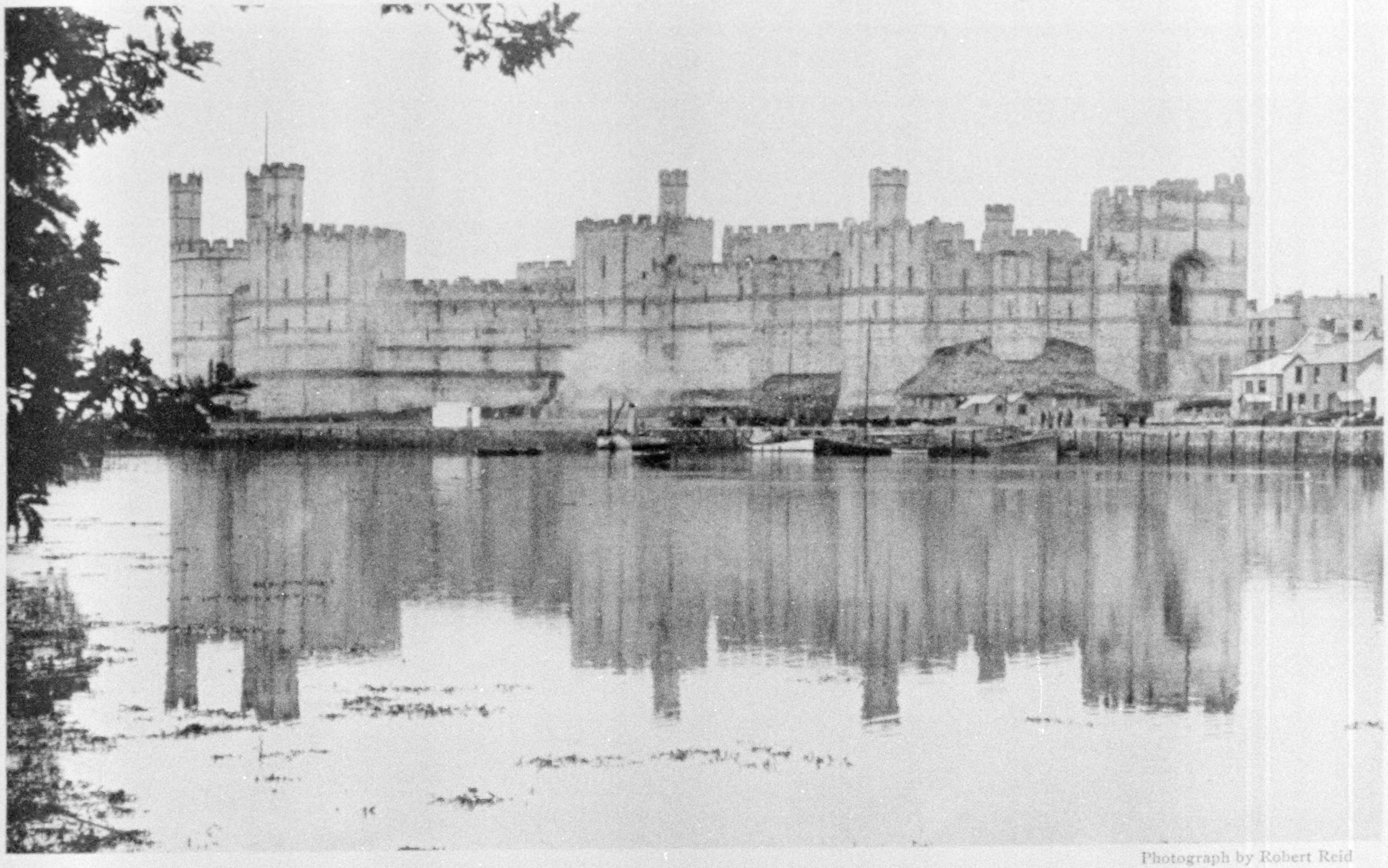
The old Welsh name for Tenby means "a precipice of fishes." This popular winter and summer watering place is superbly situated on a limestone promontory with a sandy bay on each side. An important settlement of Flemish cloth-makers was established here early in the twelfth century.



Photograph by Robert Reid

WELSH SHEEP IN MONTGOMERYSHIRE

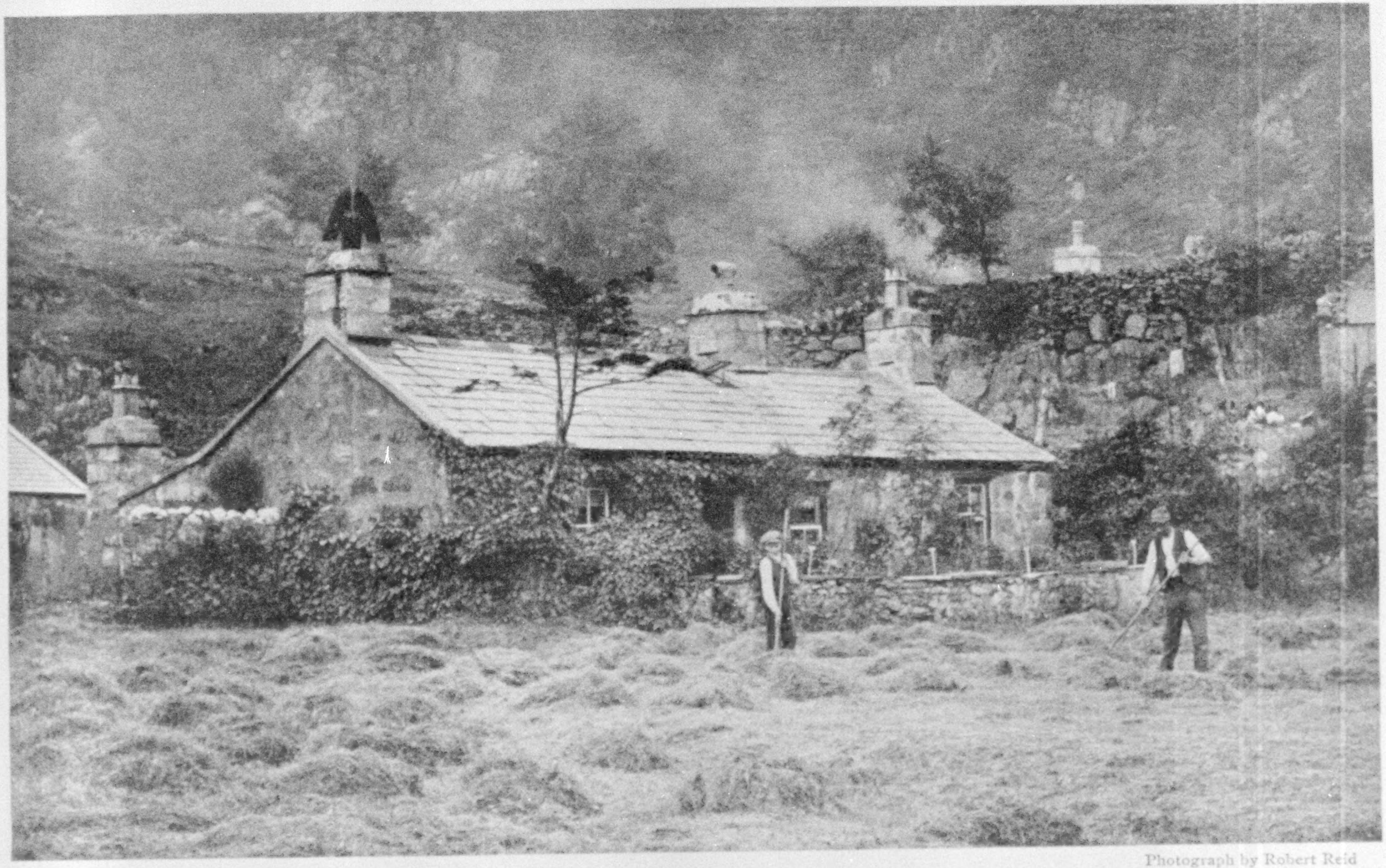
Many of the people know no English, and Welsh is everywhere the favorite tongue of the people in this county. The hardy Welsh ponies are bred among the hills and the sheep are famous. Note the numerous small fields into which the land is divided—a characteristic of a large part of Wales.



Photograph by Robert Reid

CARNARVON CASTLE, ONE OF THE FINEST SPECIMENS OF A MEDIEVAL FORTRESS IN BRITAIN

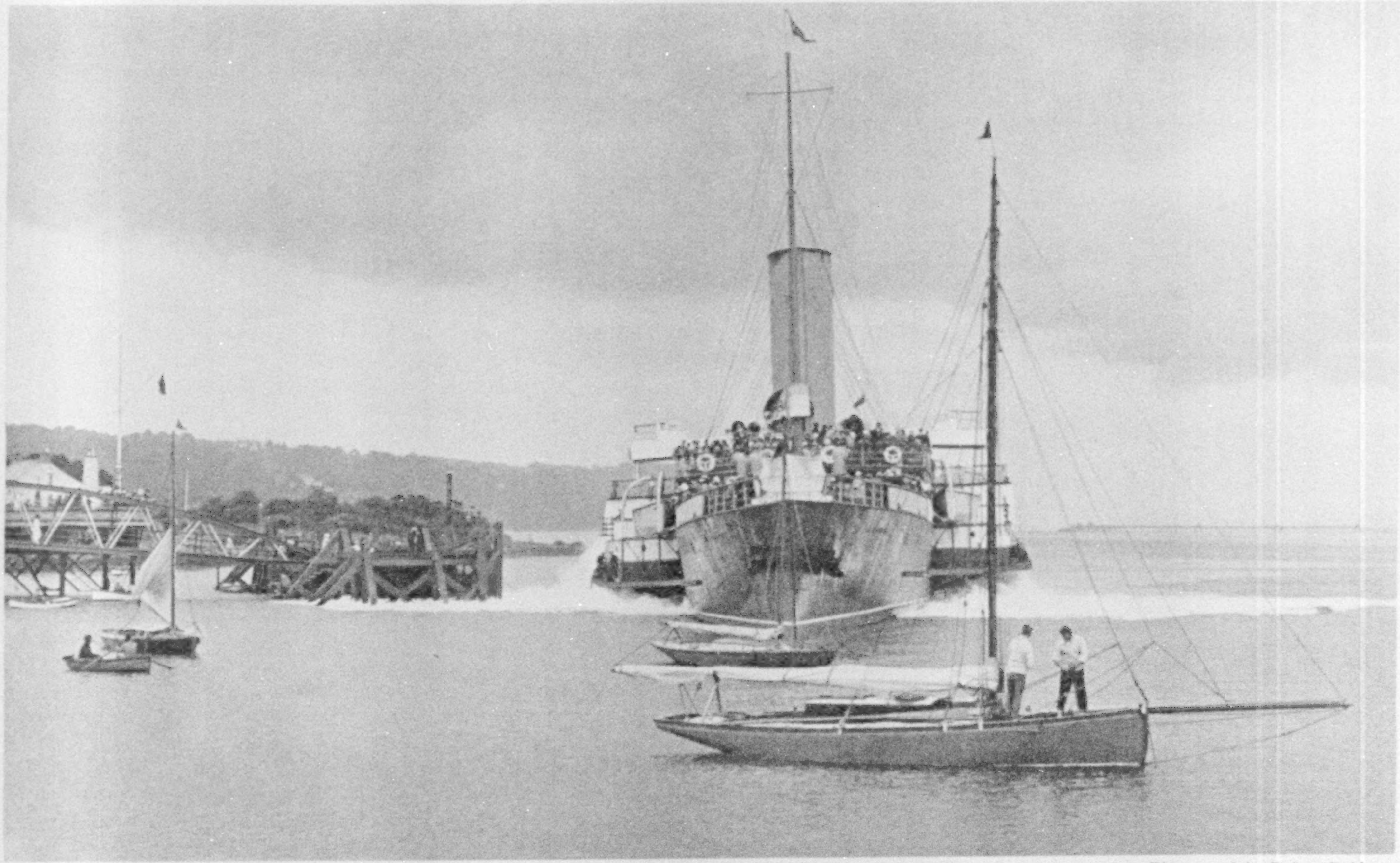
The castle overlooking the River Seiont covers an area of almost three acres. Large sums were expended in renovating it prior to the ceremonies attendant upon the investiture of the Prince of Wales here in 1911, and it is now in a fine state of preservation (see also text, page 643, and illustration, page 642).



Photograph by Robert Reid

A COTTAGE OF NORTHERN WALES

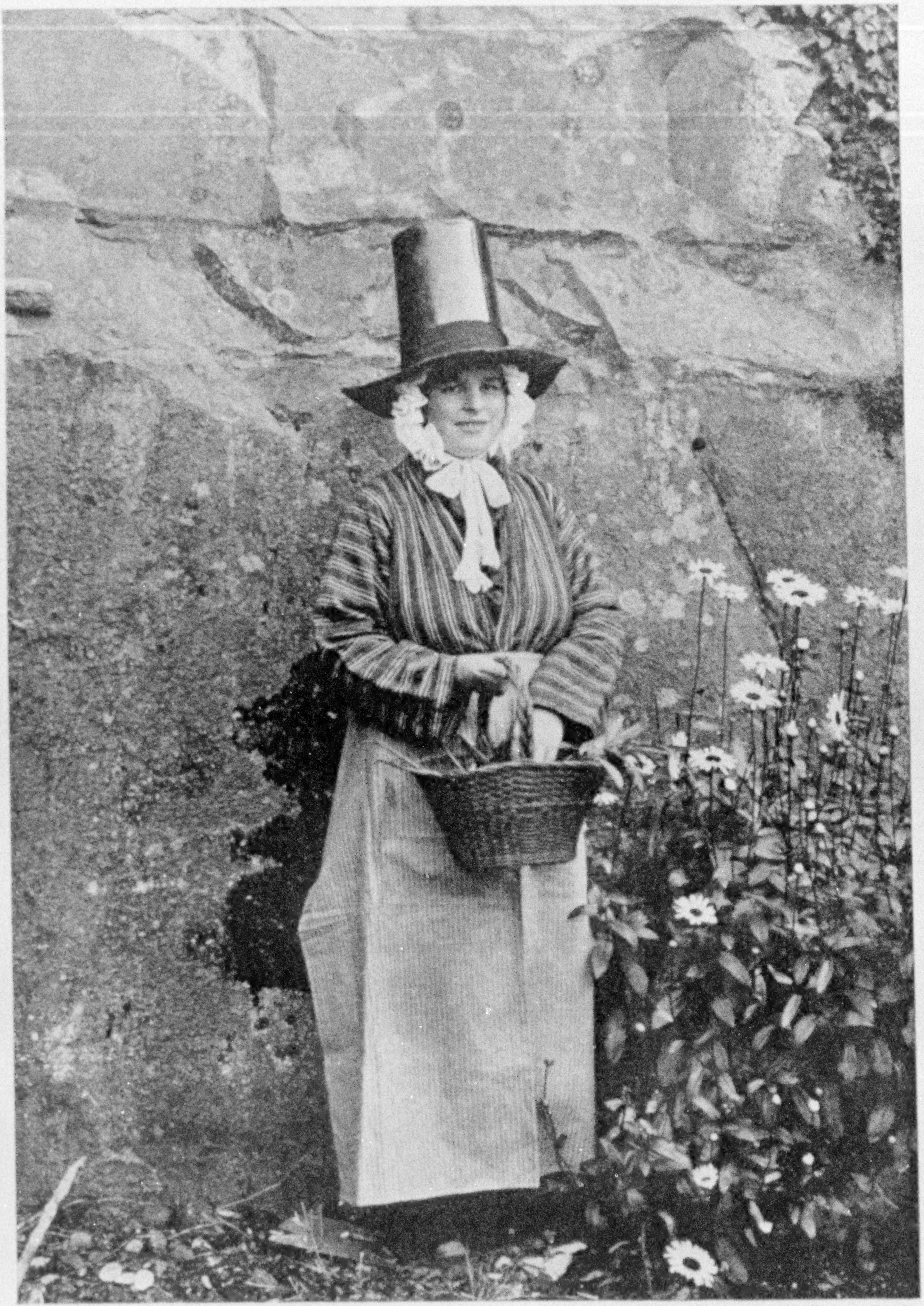
In the villages the rents are very low; a nice cottage can be leased for 60 cents a week.



Photograph by Robert Reid

"LA MARGUERITE" ARRIVING AT MENAI BRIDGE

During the summer season, there are regular sailings between Liverpool and Welsh watering places, and in fine weather the pleasure steamers are usually crowded.



Photograph by Robert Reid

A GIRL OF SNOWDONIA IN WELSH COSTUME

This girl is employed by an enterprising merchant to sell his wares at a tourist resort near Mount Snowdon. Her costume is almost as much out of date as that of Priscilla would be in New England to-day.

celebrating the end of the war, the Welsh soldiers decided almost spontaneously upon a Festival of Song, which was held on every battle field where there was a Welsh contingent in the line.

Illustrative of the importance which music plays in the life of the Welshman, there was a war-time anecdote which told of eight Britons who were found in a dugout after a 12-hour bombardment. The two Irishmen were still fighting, the two Scotchmen were holding a debate, the Englishmen had not yet been introduced, but the two Welshmen were busy organizing an Oratorio Society.

At a recent Eisteddfod held in the village of Ammanford, South Wales, there were more than 18,000 spectators, including Welshmen who had returned for the occasion from the four corners of the world — from the United States, from Canada, from Australia and New Zealand, from India, Patagonia, and even the Fiji Islands.

The choruses, solos, and contests in poetry, history, and criticism last for several days and continue from early morning until late at night.

THE EISTEDDFOD PLAYS THE RÔLE OF A PEOPLE'S UNIVERSITY

The object of these great gatherings is to perpetuate the Welsh language, popularize Welsh literature, and afford the people the cultural advantages of good music. How effective they have been in maintaining the ancient language may be judged from the fact that Cymric is in every-day use on all railway time-tables, in shops, in churches, and other public places; for, although the principality was peacefully absorbed into the realm of the Tudor sovereigns four centuries ago, eight per cent of the people of Wales and Monmouthshire speak only Welsh, while nearly a third of the inhabitants speak both Welsh and English.

In Scotland, less than one-half of one per cent of the people speak their ancient tongue exclusively, and less than four per cent speak both Gaelic and English. In Ireland, despite the intense nationalism of its people, less than four per cent speak Irish (Gaelic) exclusively, and only one-eighth of the inhabitants speak both Irish and English.

It is only a few miles' ride by train or char-à-bancs from Carnarvon to Llanberis, where the ascent of Mount Snowdon may be made by footpath or by a rack-and-pinion railway.

This peak simply must be scaled by every visitor to Wales. What do you think of the view from Snowdon? is the first question the returned tourist is asked, and if he has no answer he might as well have made a trip to Washington without going up in the Washington Monument, seeing the Capitol and the Library of Congress, and making a pilgrimage to Mount Vernon.

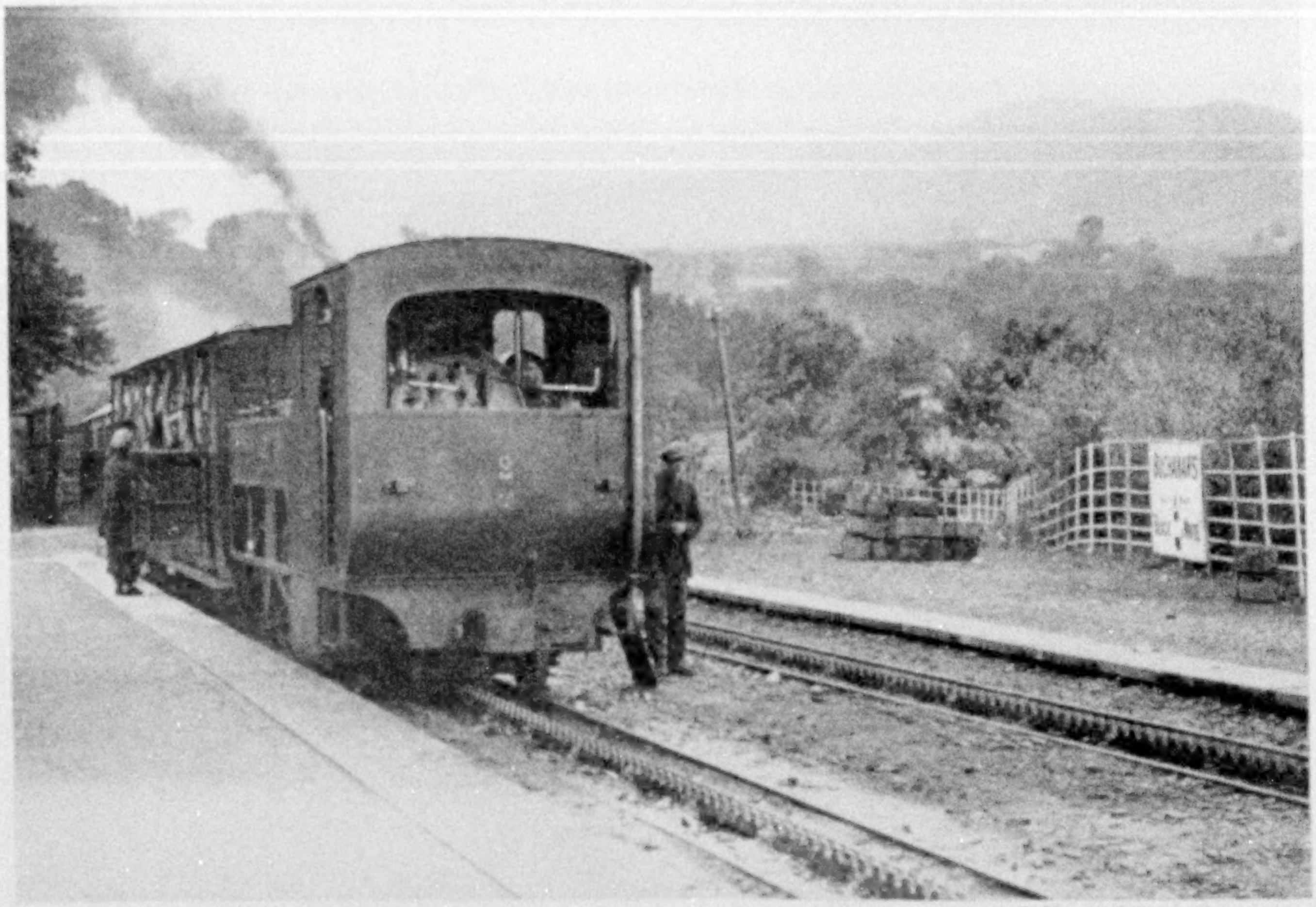
THE ASCENT OF MOUNT SNOWDON

Those of us who have no penchant for time-consuming mountain-climbing—and who of us has when only a week-end is allotted to such a fascinating country as Wales?—will utilize the tiny railway, provided there is a sufficient number of tourists of similar inclinations to induce the conductor-engineer to make the trip. Of course, if anyone is a spendthrift he can buy eight tickets for himself, and the puffing little engine will begin its complaining push-push journey. More than an hour is required to reach the top—3,560 feet above sea-level.

The upward climb affords a succession of magnificent pictures of billowing hills, of tiny lakes tucked in their pockets, of occasional glimpses of the Menai Strait or Carnarvon Bay, of slate quarries, clinging perilously to the mountain side, and of the silently enveloping waves of cloud and mist through which radiant shafts of sunlight pierce from time to time to give color to the adjacent slopes, with their bits of pasture here and there, on which flocks of sheep are forever clip-clipping the luxuriant herbage.

But as for the clear-weather view from the summit! That must be left to the guidebook author who maintains that "the outlines of the Cumberland Mountains, the Isle of Man, the Wicklow Mountains in Ireland, and Holyhead Mountain on the coast of South Anglesey, 32 miles distant, can be seen." On my visits to the summit, only the contiguous peaks could be discerned through the alternately lifting and lowering mists.

It is true that the guidebooks caution



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READY FOR THE CLIMB UP MOUNT SNOWDON

The rack-and-pinion mountain tramroad from Llanberis to the summit, 4¾ miles long, was begun in 1894 and completed in less than three years (see text, page 661).

the visitor against these mists and storm clouds and suggest guarding against disappointment by taking the following precaution: "Stand upon the doorstep of the Free Library at Llanberis, and by looking between the two chimney stacks of the house immediately beyond the chapel opposite, you can see if Snowdon is clear."

All of which is true; but one cannot stand on the doorstep while making the railway journey. And what freaks Snowdon weather can play during the 70 minutes required for the ascent! Nothing is more exasperating than to start from Llanberis with Snowdon shining clear in the sun, reach the top in a heavy mist or in a downpour, then descend only to find the mountain's profile again sharply chiseled against the sky—nothing more exasperating except to have it happen twice or three times (see page 428).

But Snowdon is not a unique mountain in this respect. Those other show heights, Rigi-Kulm, above the Lake of Lucerne, and Mount Tamalpais, in California, have a habit of playing the same shabby trick upon the sight-seer.

If Snowdon were in the United States it would receive scant notice, in so far as its elevation is concerned. Who, for example, thinks of Mount Greylock, in the Berkshires, as a towering peak? And yet the two are within a few feet of the same height. Twenty-five of our States have within their borders loftier summits than this premier Welsh peak. Four Snowdons could be piled one upon another and Mount Whitney, in California, still could look down upon the topmost.

Measured in historic association and scenic charm, however, Snowdon holds its own with far nobler heights. It has been rightly called the Parnassus of the British Isles.

LEGEND SAYS AMERICA'S DISCOVERER CAME FROM SNOWDON'S FOOTHILLS

One of the folk tales of Snowdonia, which can be taken for what it is worth, is intimately connected with America. It was among these foothills, so the story goes, that Madoc, son of the Prince of Gwynedd, tiring of wrangling with his brothers, set forth, some time during the

Photograph by A. W. Cutler

ON THE CRICCIETH BEACH AT LOW TIDE

At high tide these sands are covered by eight feet of water.

twelfth century, to find a new land. With a hardy crew, he sailed for months across the western seas and finally came to America.

There are some Welsh philologists who profess to have found Cymric words in the old Mexican tongue, and tradition says that the Spaniards brought back a story to the effect that the Montezumas claimed descent from strangers who came in ships from the east. All of which provides sufficient material to bolster up the old wives' tales that a Welsh prince and his followers preceded Columbus to America by more than three centuries.

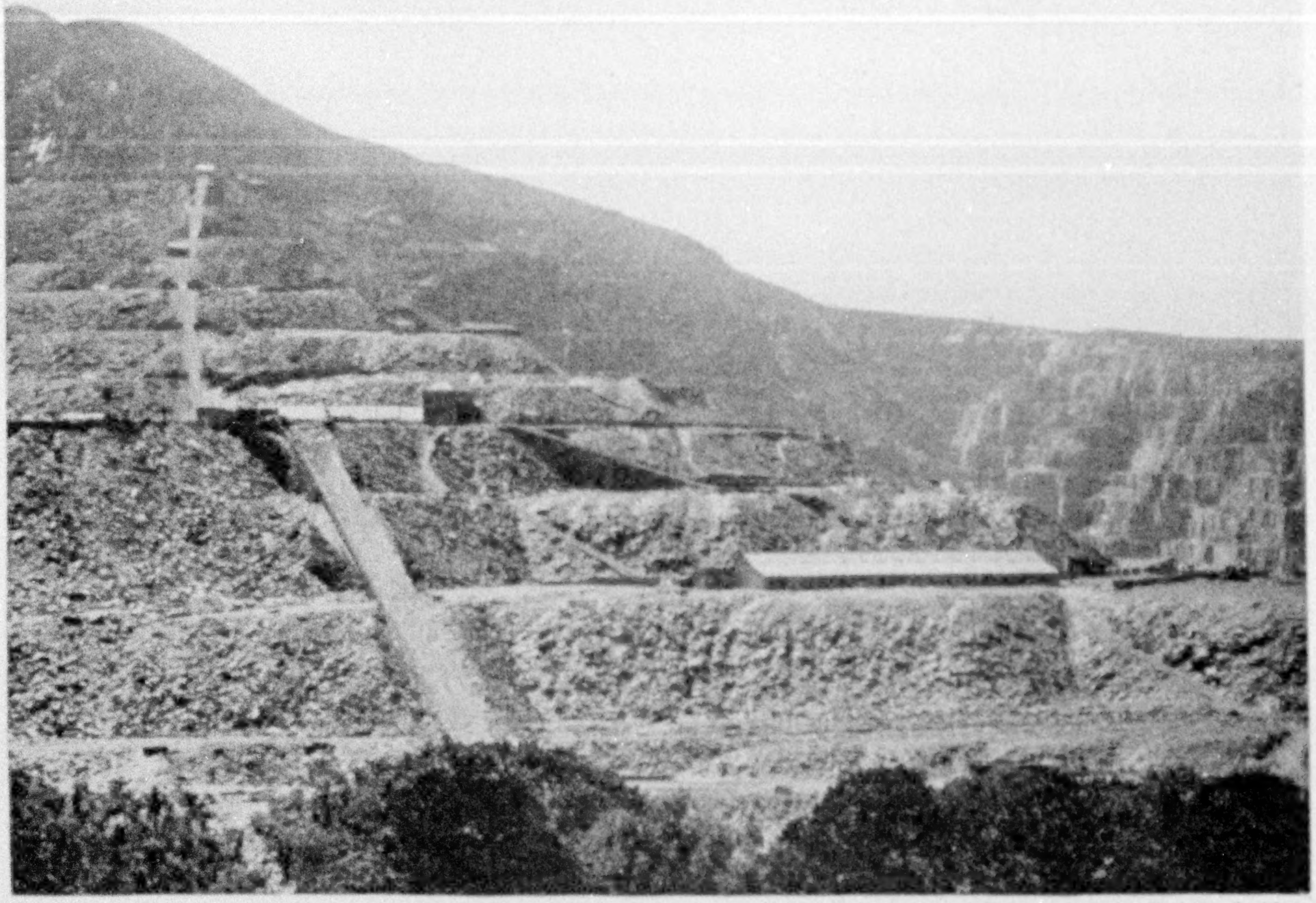
A far more substantial link between America and Wales, however, is the fact that the Mount Snowdon region was the ancestral home of Thomas Jefferson.

IN THE HAUNTS OF MERLIN THE MAGICIAN

Returning to Carnarvon from Llanberis by motor bus, we pass within sight of a wooded eminence known as Dinas Emrys. It was here that that doughty old Briton king Vortigern retired to build an impregnable tower as a shelter for his old age. But however high the walls were raised by day, they would tumble down at night. The old king consulted his advisers, who claimed that the walls would never stand until they had been sprinkled with the blood of a child who had never had a father. It's a long story, but the point of it is that Merlin proved to be the desired prodigy, born of a virgin and a demon.

When Merlin appeared before Vortigern for sacrifice, he told the king that the foundations of his tower were being laid over a subterranean lake in which dwelt two dragons, and that every night when they turned over, the walls crumbled. The lake was drained, the dragons found and slain, and Merlin was spared to live for many, many years and figure in countless Arthurian legends which have been immortalized for us by Malory and Tennyson.

Railroad schedules and motor-bus routes apparently are especially designed to meet the whims of all tourists in Northern Wales. One can go almost anywhere, at any time, usually with less than a half-hour wait at railway station or bus-stop.



Photograph by Robert Reid

THE LARGEST SLATE QUARRIES IN THE WORLD, NEAR BETHESDA, FIVE MILES FROM BANGOR

The photograph shows only a small section of the terraces (see text, page 669). There are literally mountains of slate in Wales.

And, whichever way one decides to proceed, he feels that some good genius directed his choice, for waterfalls and meadows, rolling landscapes and flashing seascapes, gladden the short journey from historic spot to delightful watering place.

TO LLANDUDNO, QUEEN OF WELSH WATERING PLACES

Our journey takes us next to Llandudno, appropriately styled the queen of Welsh watering places.

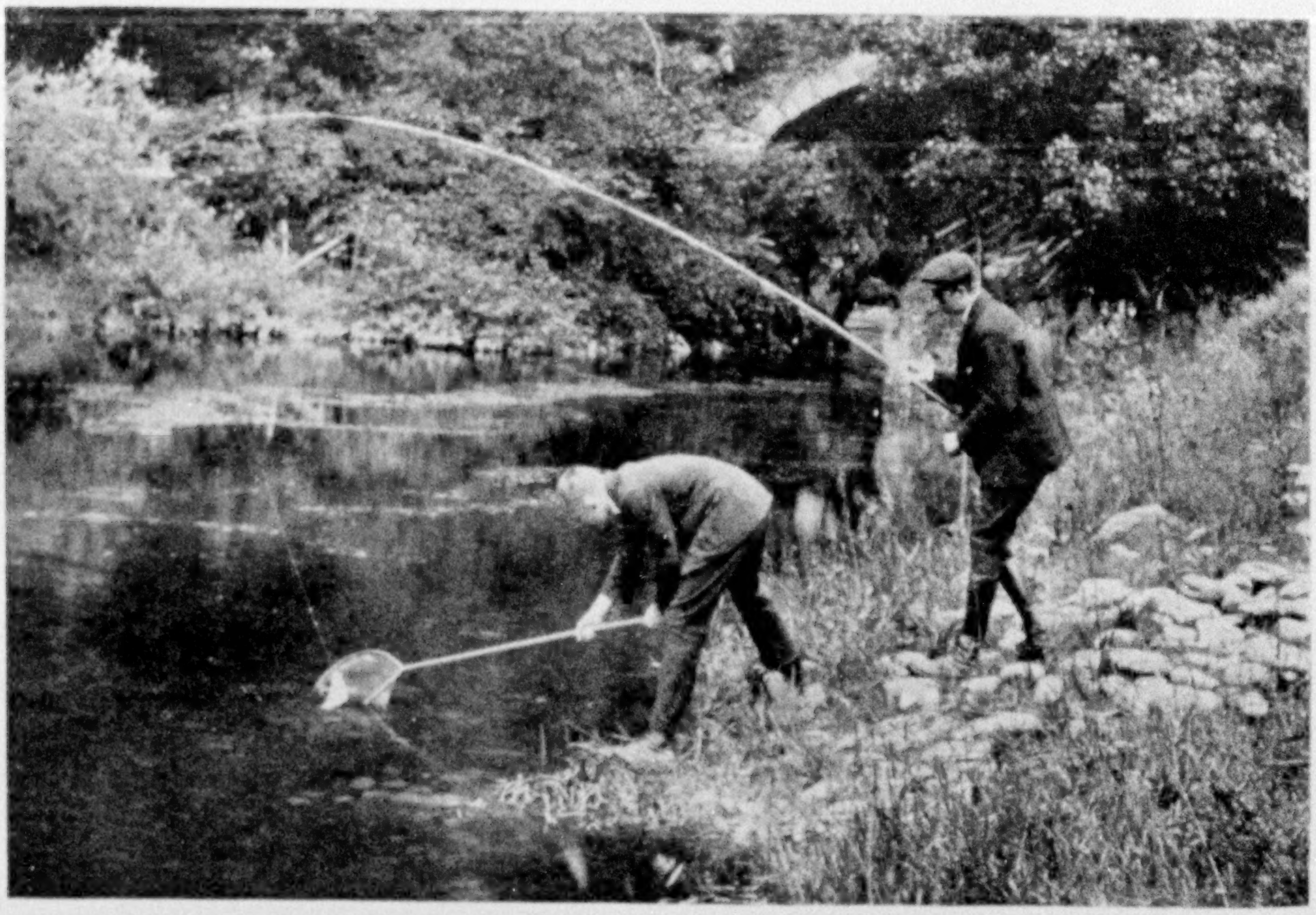
The town itself is built around a vast semicircle of firm sandy beach, with the ends of the crescent tipped with two towering masses of rock, the Great Orme's Head and the Little Orme. Neither Nice, nor Deauville, nor Biarritz, nor Scheveningen, nor any of the much-vaunted middle-Europe bathing resorts on the shores of Hungary's Lake Balaton, has a situation comparable to this magnificent watering place.

And the Welsh people have made excellent use of the opportunities which Nature presented. A concrete "boardwalk" wider than New York's Broadway follows the graceful curve of the beach for more than a mile and a half; countless bathhouses on wheels follow the tide back and forth, being drawn up and down the sands by horses; veritable droves of donkeys are provided for the children's rides when they tire of digging in the sand; a pier jutting out into the bay for half a mile is the scene of daily concerts and dances, while along its full length are booths of fortune-tellers, catchpenny venders, and other allurements which attract those who delight in such diversions while on holiday.

AN INCOMPARABLE CLIFF HIGHWAY

But it is the incomparable Marine Drive, chiseled out of the solid rock of Great Orme's Head, winding between sea and sky, midway along the precipitous cliff, which brings distinction to Llandudno over all other resorts. No similar stretch of the Corniche Drive along the Riviera can excel it in grandeur.

There are many, many spots which lure



Photograph by Robert Reid

FISHING IN THE VALLEY OF THE DYFI, NEAR DINAS MAWDDWY

The angler in Wales frequently is required to pay a license for the privilege of pursuing his sport. In the vicinity of Dinas Mawddwy, for example, the trout license for the season is only one shilling; but if the fisherman wishes to take salmon he pays a shilling a day, five shillings a week, or one pound for the season.

the visitor: Happy Valley, nestling in a hollow of the Great Orme, presented to the town by Lord Mostyn as a memorial of the Queen Victoria Jubilee; the Church of Our Saviour, in whose grounds Lewis Carroll (Dr. Charles L. Dodgson), author of "Alice in Wonderland," used to romp with his youthful friends and where he received inspiration for his matchless works of imagination from Alice, the daughter of Dean Liddell, whose residence was near by; and St. Tudno's Church, a medieval structure occupying the site of the cell of St. Tudno, a hermit of the seventh century who gave his name to Llandudno (*llan* meaning church).

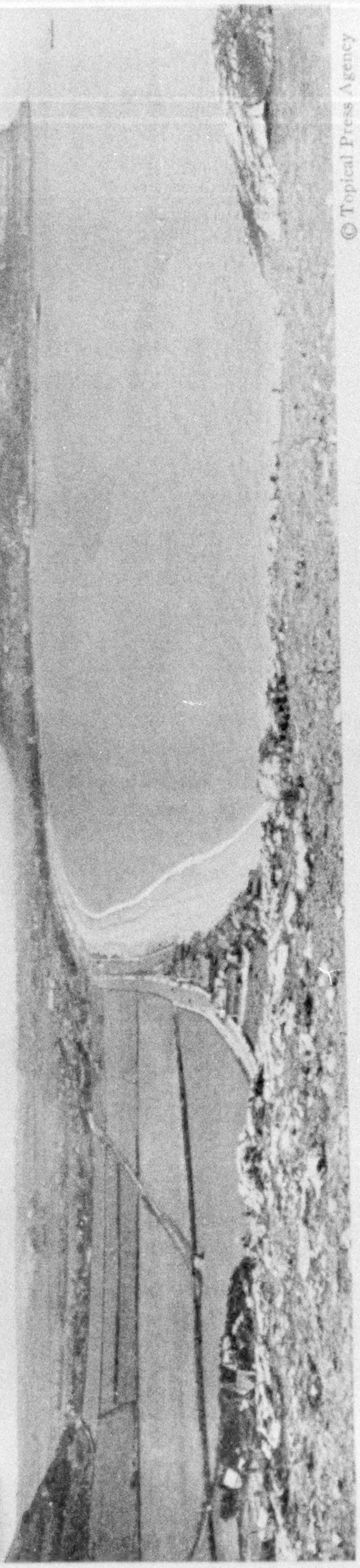
NO CONTINENTAL SUNDAY AT LLANDUDNO

In contrast to the fashionable European watering places, Llandudno achieves a puritanical, not to say saintly, calm on Sunday. There is no music on the pier, motor-bus offices are closed, all inquiry booths suspend operations, it is impossible to make railway reservations, and even the ticket offices on this day are opened for only ten minutes prior to the arrival of trains. One is compelled to rest on the Day of Rest in Wales. Incidentally, it is well to remind the week-ender that he must not defer his trip to Mount Snowdon until Sunday, for the mountain railway is not operated on that day.

One can play golf, it is true; but even on the links there is a unique rule which forbids the employment of caddies on Sunday! This may impress the average golfer as not much of a hardship, but he should be reminded that on Llandudno's North Wales Golf Course, which overlooks the Irish Sea, there are, if memory, fortified by an atrocious score card, serves aright, only four greens which can be seen from their driving tees. The rest are blind, and the stranger drives usually into the teeth of a near-gale, willy-nilly, over a tossing sea of sand dunes, guided only by a direction flag.

Monday morning must provide a bonanza of lost balls for the caddies.

There is an interesting colony of summer residents in Llandudno which the



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LLANDUDNO AND GREAT ORME'S HEAD AS SEEN FROM LITTLE ORME (SEE TEXT, PAGE 664).

tourist rarely sees and of which he seldom hears. They are Moroccan merchant princes and their entourages.

These princes reside in England half the year, purchasing cotton goods at Manchester for the consumption of the Mohammedan world. In summer they move their families to Llandudno, leasing apartments in the many "boarding residences," as the smaller hotels are called, where they dwell in more or less seclusion. Their secretaries commute 85 miles to Manchester twice a week to transact the necessary business during the dull season.

CONWAY CASTLE AND THE HOUSE OF QUEEN ELIZABETH AND LEICESTER

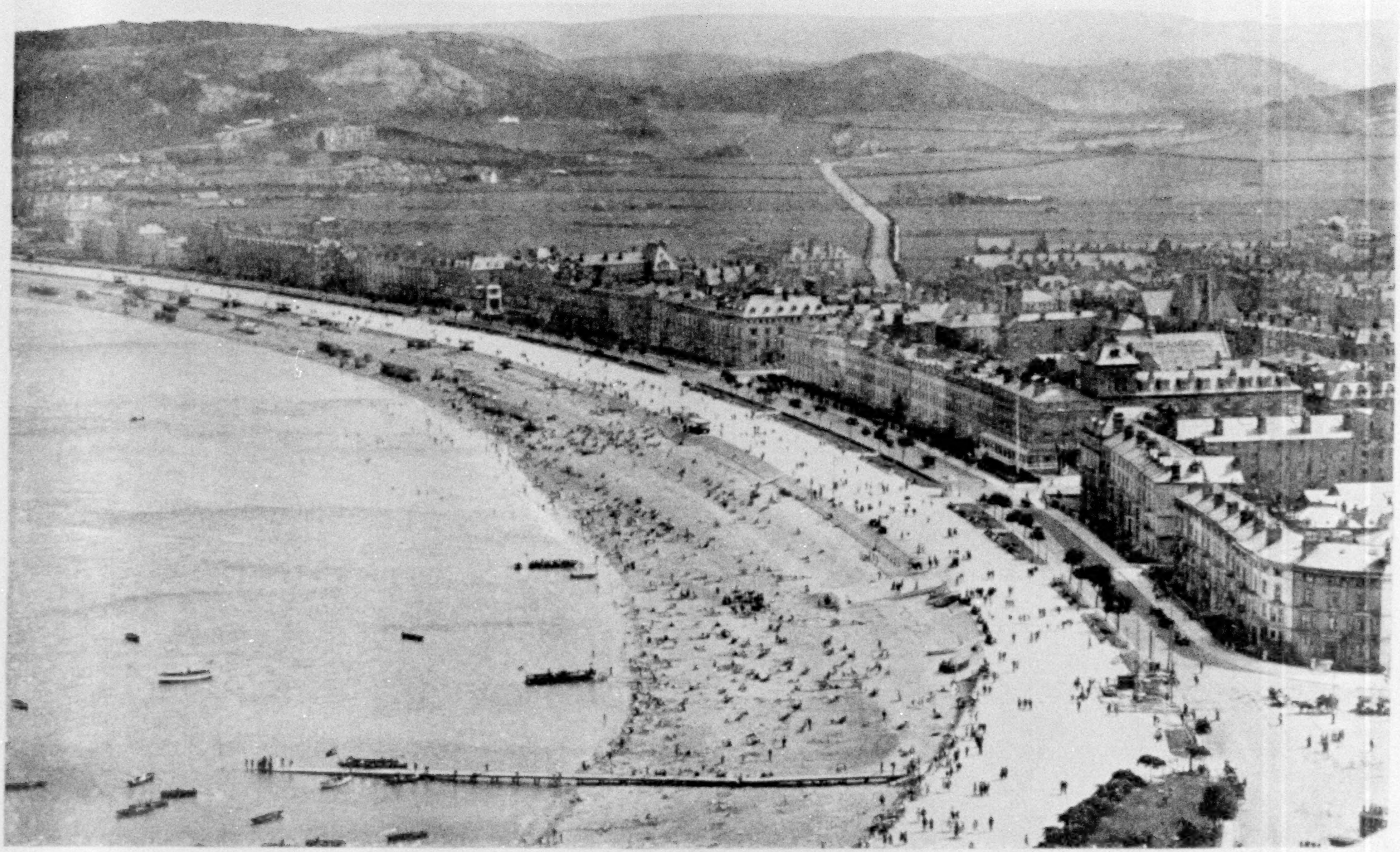
The summer sight-seer enjoys the advantage of long days in this part of Wales, and in July a newspaper can be read in the open as late as 10:30 in the evening.

These twilights are apt to deceive one, and many a tourist stopping in Llandudno defers his visit to adjacent Conway until its great castle is closed for the day.

Conway Castle, like that at Carnarvon, has Welsh history graven on every stone. It, too, was built by Edward I (see page 644), but it has not been restored, as was the birthplace of the first English Prince of Wales. Its dismantled appearance is attributed to an Earl of Conway in the time of Charles II, who, under the pretense of the requirements of His Majesty's service, had all the iron, timber, and lead in the building torn out and shipped to Ireland, where he expected to sell it.

This act of vandalism had its own reward; the ship bearing the material was wrecked and the contents swallowed up in the Irish Sea.

Of close secondary interest to the castle is Plas Mawr ("the Great Mansion"), a picturesque sixteenth-century house, in which Queen Elizabeth and her favorite, the Earl of Leicester, are said to have spent many happy days. It is now the headquarters of the Royal Cambrian Academy of Art. Of course, it has its haunted chamber, known as the Lantern Room, and some one with a passion for figures has ascertained that there are 365 windows and 52 doors in the building,



Photograph by Robert Reid

OVERLOOKING LLANDUDNO FROM THE GREAT ORME

The most popular seaside resort in Northern Wales is thronged with visitors during July and August. The main portion of the town lies along a crescent-shaped bay, flanked by two prominent headlands, the Great and Little Orme. A wide and spacious promenade, provided with numerous seats and shelters, skirts the bay, and the firm, clean sands make an ideal playground for children. Note the individual bathhouses, which are shifted back and forth across the beach, as needed by the bathers (see text, page 664).

XUM

Photograph by Robert Reid

DONKEYS FOR THE CHILDREN ON THE BEACH AT LLANDUDNO

corresponding to the days and the weeks of the year.

Every visitor to Conway pays a pilgrimage to the little Church of St. Mary, a part of which was once a Cistercian abbey founded in the twelfth century. Inside is a tombstone which records the fact that "Nicholas Hookes, of Conway, Gent., who was the forty-first child of his father, William Hookes, Esq., by Alice, his wife, and who was himself the father of twenty-seven children, died on March 20th, 1637."

In the adjoining churchyard is a tombstone, protected from relic-hunters by an iron screen, which is reputed to mark the graves of John and Jane, brother and sister of the little Maid of Conway who insisted to the poet Wordsworth that "We Are Seven."

ANOTHER ASPECT OF WALES

We may wander for many week-ends through Northern Wales without exhausting the list of quaint villages and their contiguous scenic beauties.

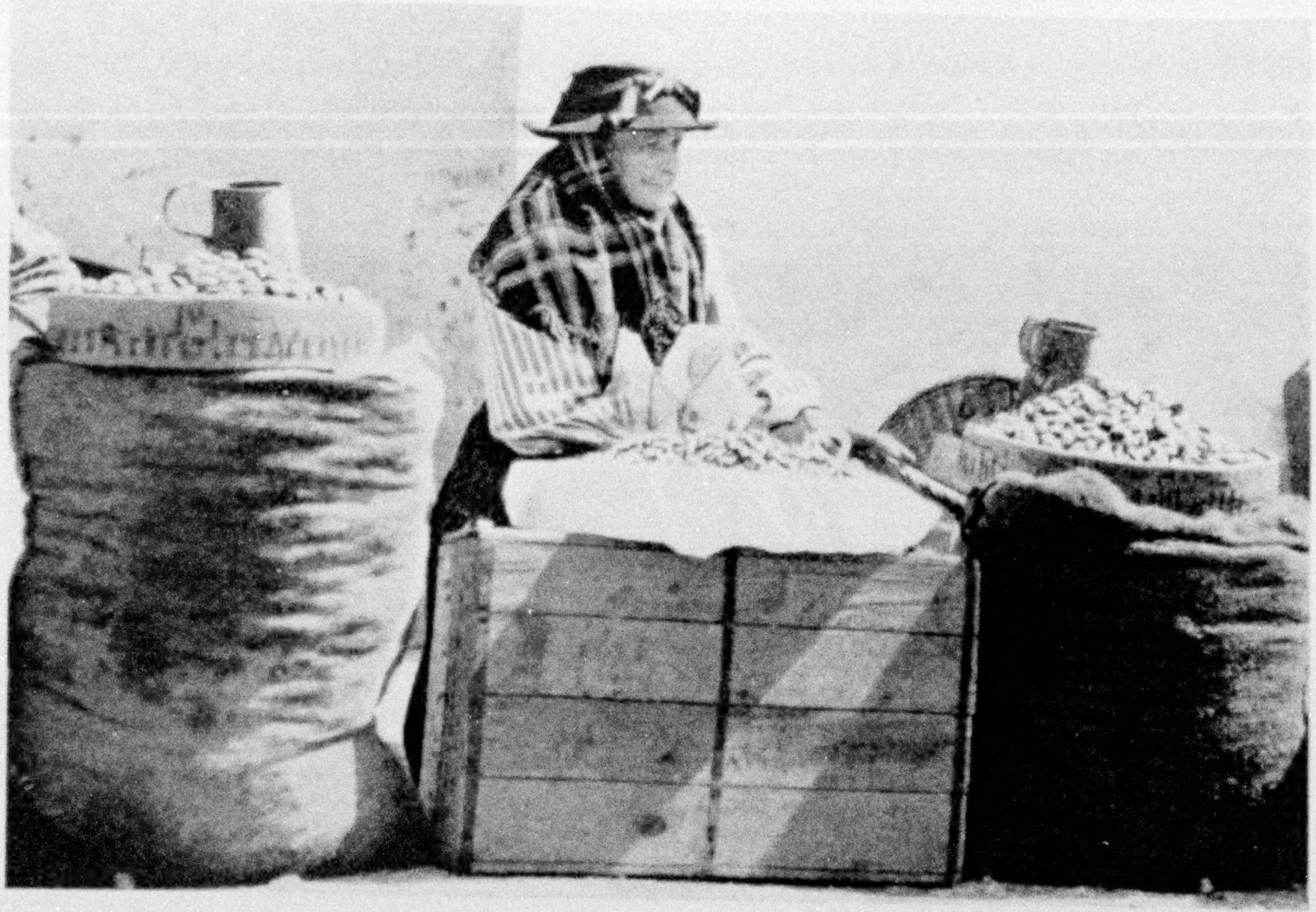
If we would look at the Wales of Industry, we must go to the south and devote more than the few fleeting hours of the casual traveler to the study of its social problems and its commercial importance.

The three largest towns of the principality—Cardiff, with 200,000 inhabitants; Swansea, with 157,000, and Merthyr Tydfil, with 80,000—are situated in Glamorganshire, a county occupying only one-ninth the country's area, but where more than half the total population is congested.

This is the great coal-mining district of Wales, where it is estimated that one person in every six (including men, women, and children) works underground, producing from 47,000,000 to 57,000,000 tons of coal annually (chiefly bituminous steam coal)—one-fifth of the annual supply of the United Kingdom. In addition, this is the only important anthracite region in Europe.

South Wales is also the copper-mining district and the great center for the tinplate industry of Great Britain. Of the 82 Welsh tin-plate mills, 65 are concentrated within a radius of 18 miles of Swansea.

There is one celebrated industrial plant, however, which the Northern Wales tourist may visit by motor bus from Llandudno. It is the Penrhyn slate quarries,



Photograph by A. W. Cutler

A WELSH COCKLE WOMAN WAITING FOR BUSINESS AT CARMARTHEN, SOUTH WALES

The cockle, which measures in its shell from one to two inches in breadth, is regularly eaten by the poorer classes of England and Wales. Cockle fishing consists of simply raking the mollusks from the sand when the tide is out.

near Bethesda. These are said to be the largest quarries in the world, and have at times employed as many as 3,000 workmen, producing 360 tons of slate a day. The quarries resemble a vast amphitheater with tiers 50 feet in height (see page 664).

WITCH'S HAT DISAPPEARS, BUT THE GELERT LEGEND GOES ON FOREVER

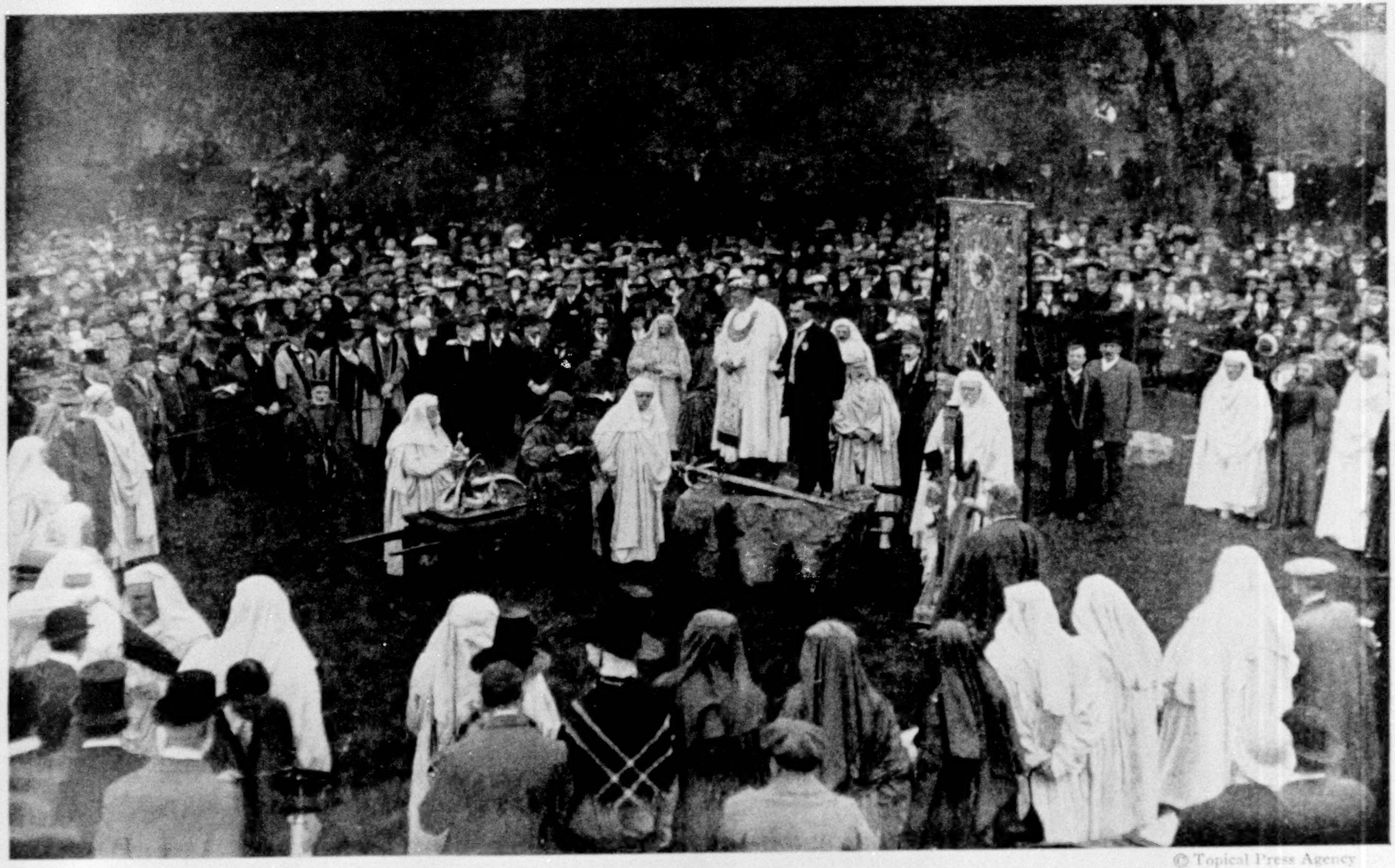
One may—and usually does—wander through the towns of Wales for days or weeks without at any time encountering a single individual wearing the "witch's hat" which most of us think of as "typically Welsh" before we visit the country. In fact, the only survivals of the national costume seen nowadays are those worn at the Eisteddfodau (see page 644) and those displayed in museums or as "fancy dress" (see pages 651 and 660).

But one never goes to Wales or reads a book on Wales without encountering two stand-bys of the centuries—the story of the hound of Beddgelert, and a certain place name on the island of Anglesey; and although this does not purport to be an orthodox Wales travel article, subjects of such ancient and honorable lineage as these cannot be overlooked.

Beddgelert is 13 miles by motor bus from Carnarvon. The town itself is the center for many charming walks, but our visit is for the purpose of dropping a supposititious tear on the apocryphal grave of Gelert, a dog belonging to one of the Llewelyn clan. His master, you will recall, returned home one day to find the dog covered with blood and the cradle of his child overturned. In rage and grief, Llewelyn instantly slew the dog.

But when the cradle was righted the child was found unharmed, with a dead wolf at its side. Llewelyn, realizing too late that he owed his son's life to the dog, buried the animal and placed a stone over his grave, where the credulous and incredulous alike come to pay their tribute to this prototype of "mankind's best friend."

The second Welsh stand-by is not legendary but geographical. It is the first village on the Anglesey shore, four



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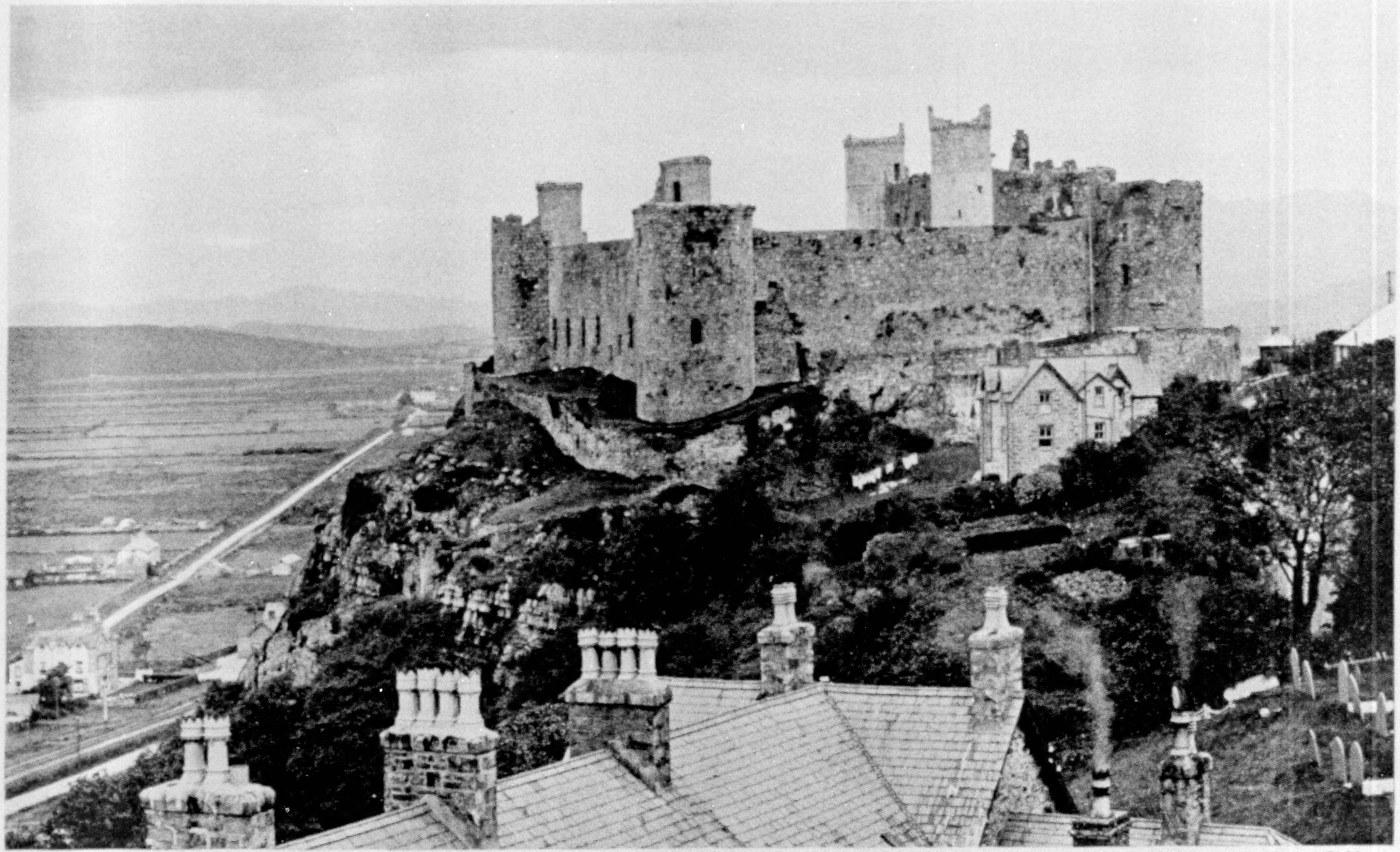
A SCENE AT THE OPENING OF THE WELSH NATIONAL FESTIVAL OF SONG, MUSIC, AND POETRY AT ABERYSTWYTH

The Gorsedd, or governing body of the Eisteddfod, robed in white, blue, or green, according to the degree of membership, forms a circle about the Arch Druid. The Arch Druid is here shown standing upon the stone from which he delivers his annual address. Beside him is a candidate who has been presented for membership in the Gorsedd.

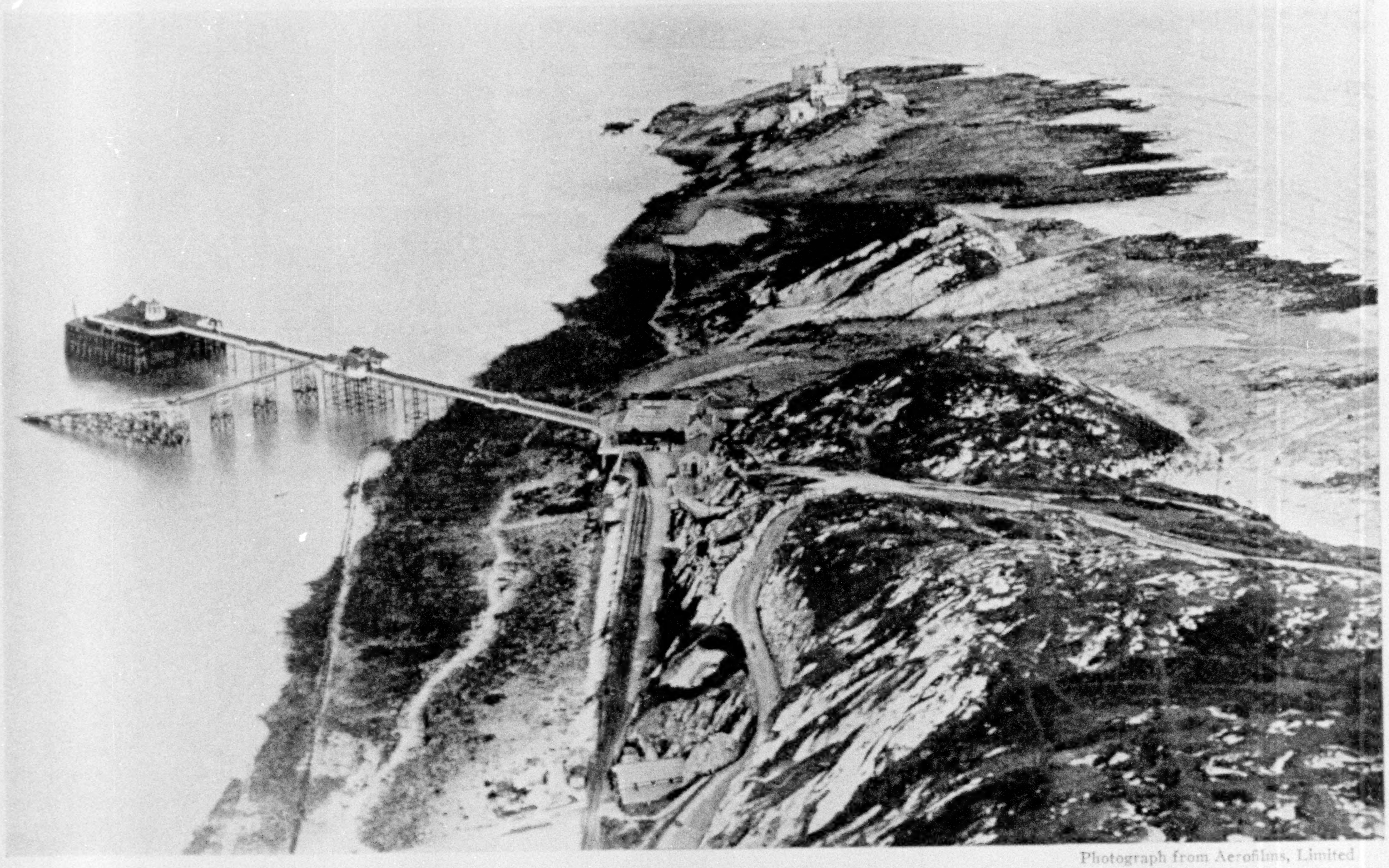


Photograph by Robert Reid

HARLECH CASTLE, ON THE OPPOSITE SIDE OF THE BAY FROM CRICCIETH

This magnificent fortress, on a cliff overhanging a stretch of marshy land, was built by Edward I in the thirteenth century (see text, page 644). It was made famous in 1468. Dafydd ap Einion, a soldier of spectacular bravery attached to the House of Lancaster, when called upon to surrender the castle to the Earl of Pembroke, replied by messenger: "Tell your leader that some years ago I held a castle in France for the king so long that all the old women in Wales talked of it; and now I intend to hold this Welsh castle until all the old women of France shall talk of it." The hardships suffered by his garrison, which was finally starved into submission, are said to have inspired the famous national song, "March of the Men of Harlech." A fine view of the Snowdon hills can be had from its walls.

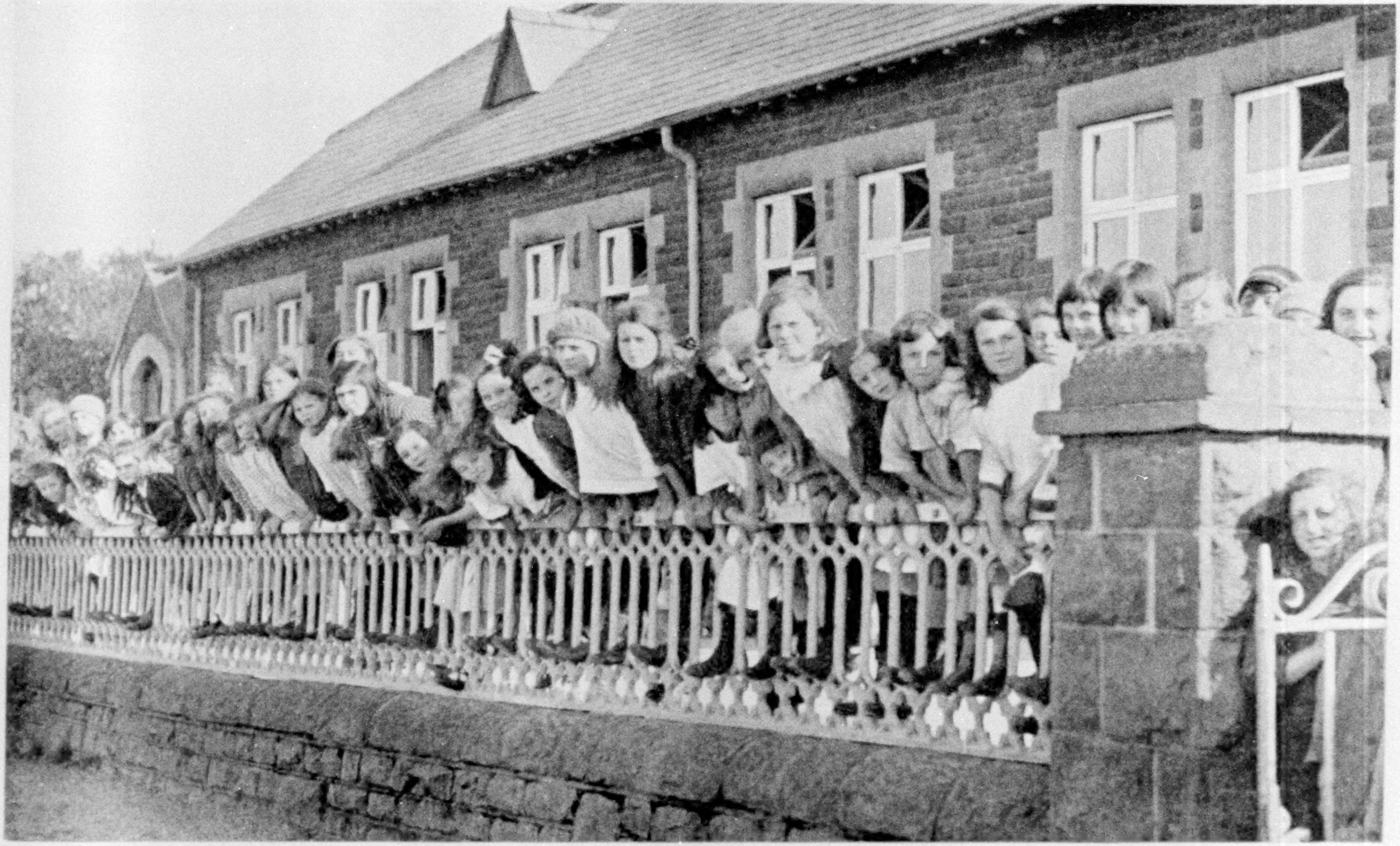
XUM



Photograph from Aerofilms, Limited

AN AIRPLANE VIEW OF "THE MUMBLES," NEAR SWANSEA, SOUTH WALES

The Mumbles Head lighthouse is famous in Welsh maritime lore on account of the heroism of its "Grace Darlings," the Sisters Ace, daughters of the lightkeeper. The curious name "Mumbles" is said to be derived from the moaning, mumbling sound of the waves, or from a corruption of "mammals," having reference to the rounded appearance of the islets.



Photograph by Robert Reid

A GROUP OF WELSH SCHOOL CHILDREN MANIFESTING INTEREST IN THE GEOGRAPHIC PHOTOGRAPHER

Photograph by Maynard Owen Williams

FRENCH SCHOOL CHILDREN WITH AMERICAN FLAGS AT THE DEDICATION OF THE CANTIGNY MEMORIAL (SEE OPPOSITE PAGE)

The dedication exercises took place on Bastille Day, July 14, 1923, the great French national holiday when usually only the Tricolor is displayed But as a special honor to America, the Stars and Stripes were carried by the children when the National Geographic Society presented the memorial fountain and water-supply system to the historic little French village.

miles from Bangor. Practical mapmakers irreverently label it briefly "Llanfairpwllgwyngyll," or even merely "Llanfair P. G." (see sketch map, page 639), but its unabridged, honest-to-Cymric name is *Llanfairpwllgwyngyllgogerychwyrndrobwllllandysiliogogogoch,* which means "Church of St. Mary in a hollow of white hazel, near to a rapid whirlpool and to St. Tysilio's Church, near to a red cave."

The street urchins of Llan-etc., reap a considerable harvest from tourists, who pay a penny to have the name pronounced, and, considering the length of service rendered, the fee would seem to be within reason.

But to him who has once reveled in the delights of week-ending in Wales, not even the pronunciation of Llan-etc., and its sister villages, can quell the longing to repeat the experience.

THE NATIONAL GEOGRAPHIC SOCIETY'S MEMORIAL TO AMERICAN TROOPS

Fountain and Water Supply System Presented to Historic French Town of Cantigny, Where Our Overseas Soldiers Won Their First Victory in the World War

TO BUNKER HILL and Gettysburg the World War added another holy place of American history—Cantigny.

At this little white stone village of France, American overseas troops, fighting as a unit, first exhibited their valor and received their first baptism of German fire.

Members of the National Geographic Society have the honor of bestowing upon this Old World shrine the first memorial gift commemorating an event and a place which will loom ever larger in the perspective of history.

On Cantigny's tiny hill, near Montdidier, some twenty miles southeast of Amiens,* this memorial was tendered to the village, in the name of The Society, in the presence of high French officials, on France's beloved Bastille Day, July 14, 1923, by Dr. J. Howard Gore, a member of The Society's Board of Trustees and chairman of the Memorial Committee.

The character of the gift was determined by the Cantigny Town Council and consists of a complete water-supply system for the village, including a capacious artesian well and pump, a handsome central fountain, a large pond, and accessory water pipes and outlets to all parts of the village.

Upon the white marble fountain is a tablet bearing, in English and in French, this inscription:

Here at Cantigny
on May 28, 1918

The American Forces Won
Their First Victory
in the World War

In Memory of a Comradeship
then reaffirmed
The National Geographic Society
of North America
Dedicates This Fountain

Many official delegations attended the ceremonies, including a color guard from the American Legion, but among the most picturesque groups that gathered there were French school children bearing American flags (see page 674).

In explanation of the circumstances leading to the presentation of the memorial, Dr. Gore, in his address of presentation, said:

"The National Geographic Society, with a membership of 800,000, under the leadership of its resourceful and energetic

---

* See map, "Western Theater of War," Special Supplement in colors, 26¼ x 31 inches, NATIONAL GEOGRAPHIC MAGAZINE, May, 1918.

Photograph by Maynard Owen Williams

THE COLOR GUARD FROM THE AMERICAN LEGION

president, Dr. Gilbert Grosvenor, was active in many lines of endeavor to aid the Allied cause and to contribute to the welfare and comfort of our soldiers at home and abroad. At the close of the war The Society, finding itself with an unexpended balance of a fund, decided to utilize it in erecting a memorial to our participation in the great conflict."

The fund Dr. Gore referred to was that voluntarily contributed by The Society's members to establish and equip National Geographic Society wards in American Military Hospital No. 1, at Neuilly, France. The Society's trustees decided that the remainder of this fund, following the closing of the hospital, no longer needed to minister to the men, could best be used to memorialize them.

Cantigny was chosen as the recipient for this gift upon the advice of General Pershing, who in his official report had called the Cantigny engagement "a brilliant action, which demonstrated our fighting qualities under extreme battle conditions."

It was the First American Division that first went over the top at Cantigny. War records since have disclosed that the German General Staff had ordered that the heart be taken out of the Americans, at any cost, when they first showed up as a unit anywhere on the fighting front.

Therefore an order, commonplace enough in itself, for the Americans to iron out the salient at Cantigny converted what would have been a skirmish into a terrific struggle, during which the Germans rallied thousands of men and hurled 19,000 shells into the tiny town.

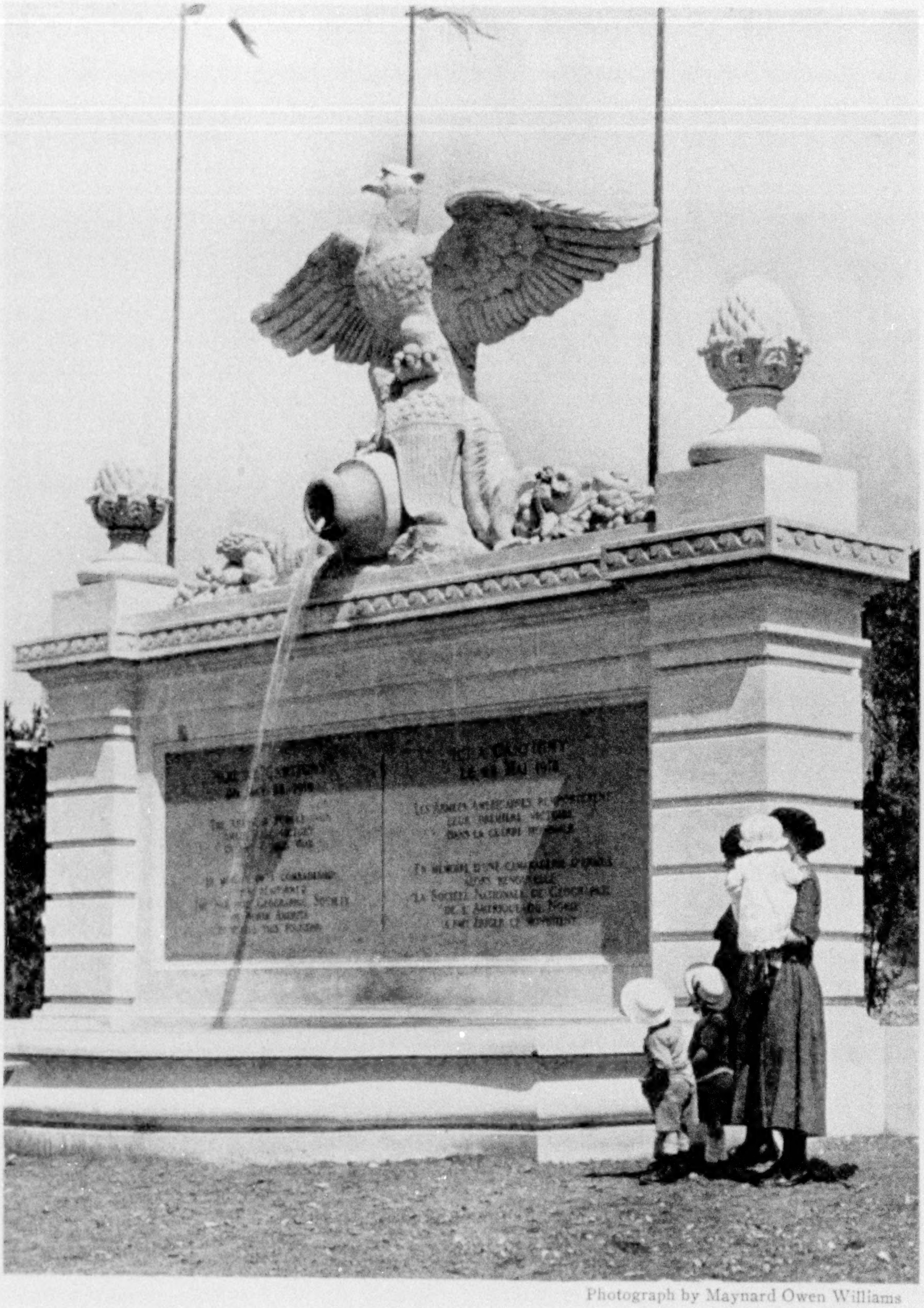
Even after Americans took Cantigny, they had to hold it against six counterattacks.

AMERICA'S ACHIEVEMENT AT CANTIGNY

An impartial and authoritative English estimate of what the American soldiers did at Cantigny says:

"Cantigny, small but proud, on its green eminence, overlooking with a mouth of fire the whole countryside, was to be taken. Never did men rise so eagerly out of trenches to go forward than those Americans.

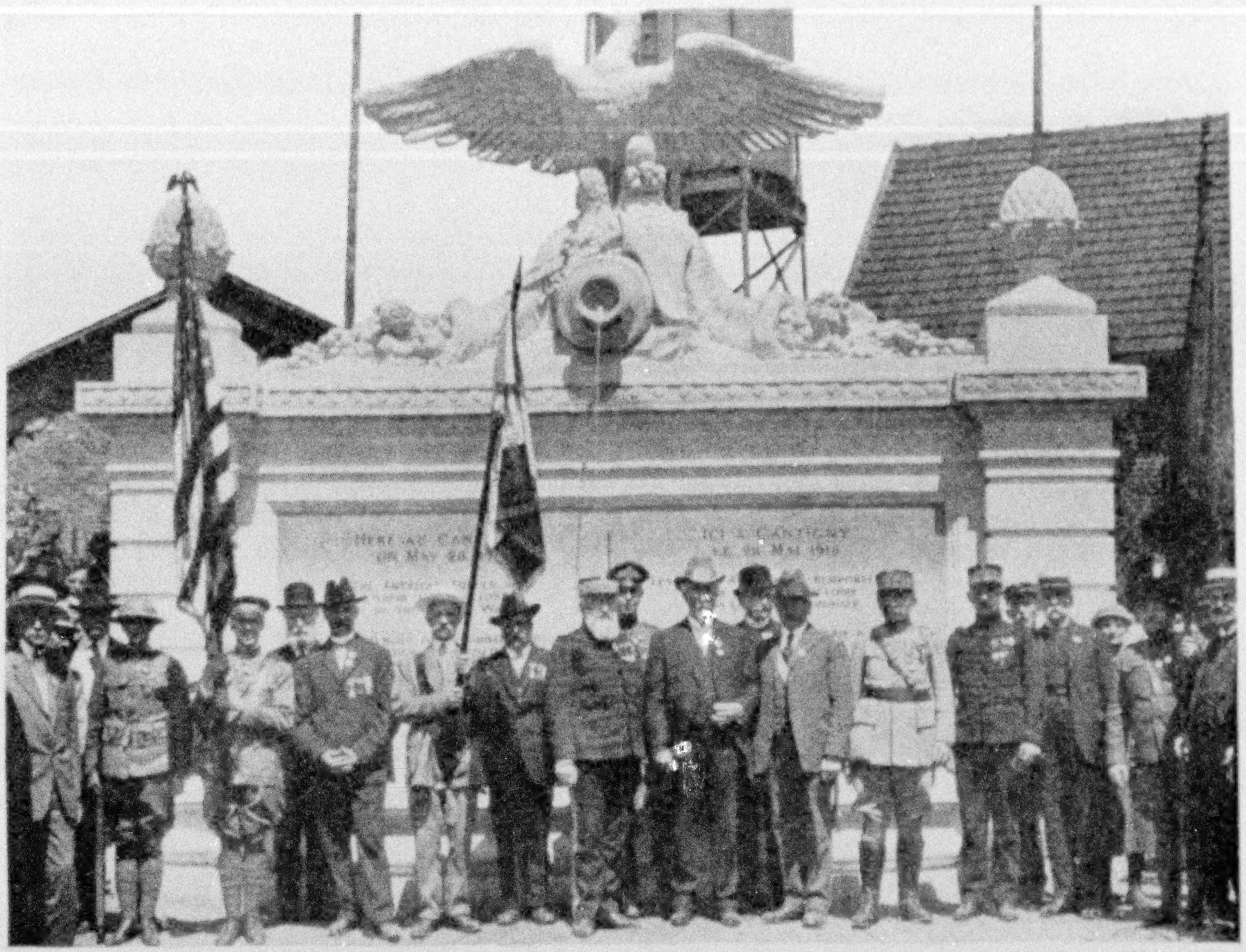
"Through gas, through a cloud of machine-gun bullets, following close behind



Photograph by Maynard Owen Williams

THE NATIONAL GEOGRAPHIC SOCIETY'S MEMORIAL FOUNTAIN AT CANTIGNY, SCENE OF AMERICA'S FIRST VICTORY IN THE WORLD WAR

The panel at the right bears the dedicatory inscription in French; on the left panel is the English (see text, page 675). The fountain was designed and constructed by M. Alexandre Marcel, architect.



Photograph by Maynard Owen Williams

THOSE WHO PARTICIPATED IN THE DEDICATION EXERCISES

At the extreme left is Col. Francis E. Drake, first departmental commander of continental Europe of the American Legion. Standing between M. Emery, Prefect of the Somme (the officer with the beard), and the Mayor of Cantigny is Dr. J. Howard Gore, Chairman of the Memorial Committee, who represented the Board of Trustees and members of the National Geographic Society, at the dedication exercises. After the mayor come General Biochut, M. Duffan, Under Prefect of Montdidier, and M. G. Grandidier, Secretary of the Société de Géographie, of France.

their barrage, they steadily ascended the slopes of the village and sheltered themselves in the cemetery when the village was theirs. The village was the first ever captured by American troops in Europe, and the lesson that the Germans learned was the first they had received from the youth of America."

Cantigny of to-day typifies the heroism of her own citizens in peace, as she once signalized the courage of the American troops.

Naturally, the "green eminence" was devastated—swept of not only every habitation, but every semblance of being a habitable place. As Dr. Gore said, "They not only pulverized the town but they blew away the dust."

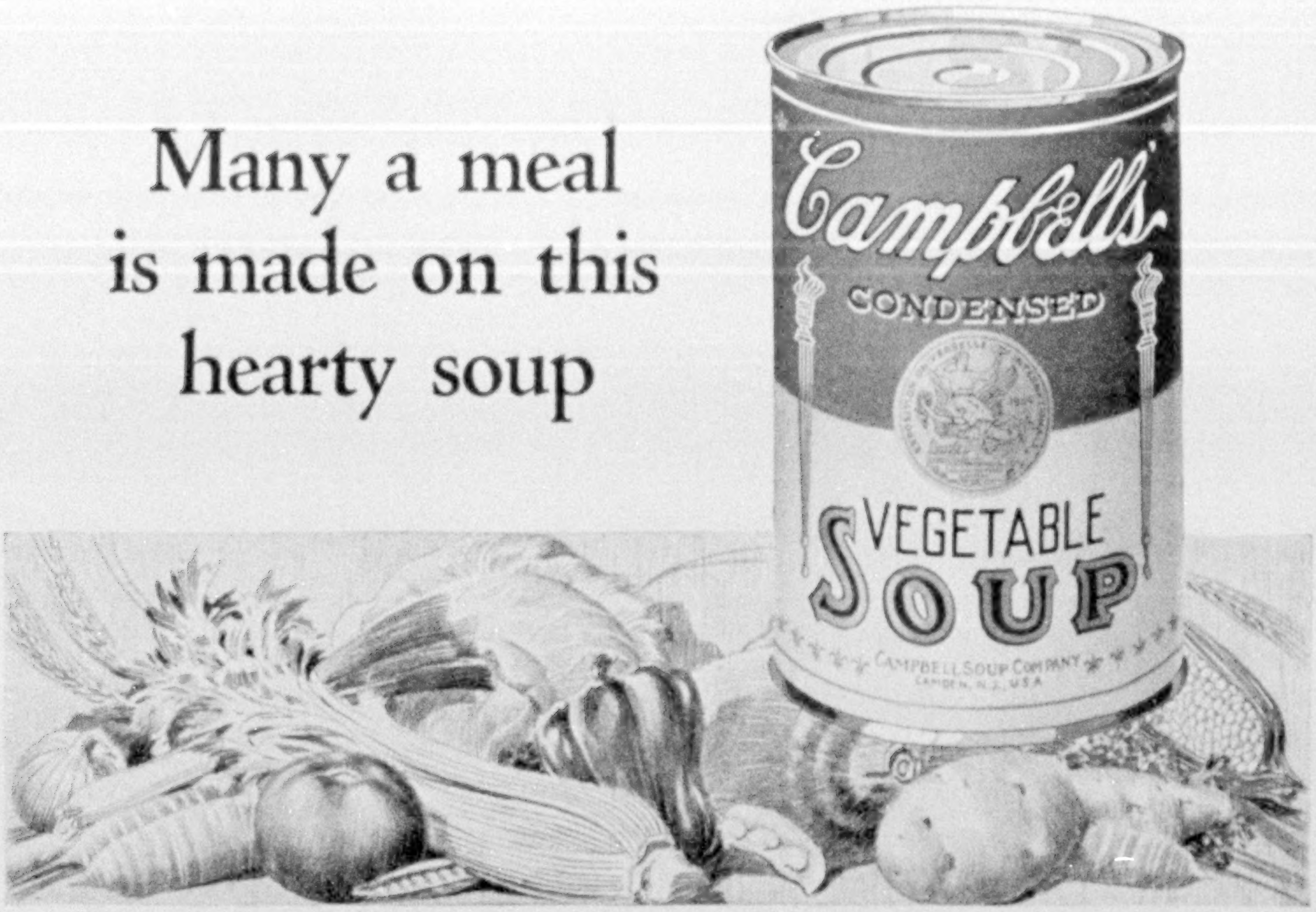
The surviving citizens of Cantigny hesitated to rebuild their homes because of the lack of water in this dry district, and it was not until the National Geographic Society offered a memorial water supply that a reconstruction of this heroic and historic town was undertaken.

The dramatic moment of the Bastille Day ceremony took place after the mayor of Cantigny had formally accepted the gift of The Society and "The Star Spangled Banner" and the "Marseillaise" uncovered the heads of the crowd.

And its significance, perhaps, was best summed up when a rosy-cheeked schoolgirl in blue presented Dr. Gore with a bouquet of countryside flowers and a bystander explained:

"It is the water your Society provided which makes our hillsides bloom."

Many a meal is made on this hearty soup



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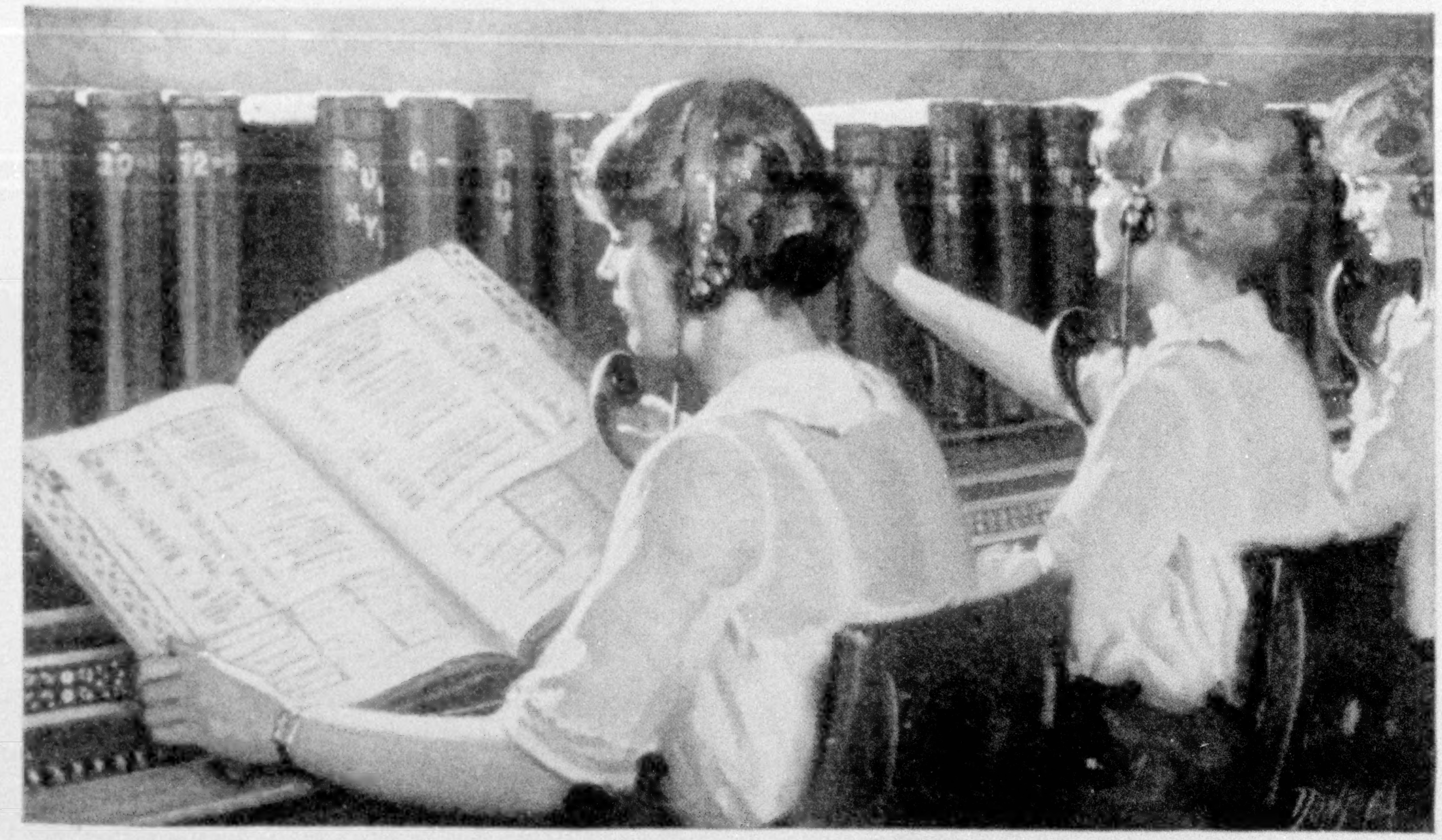

Crossroads of Conversation

Could the telephone directory in the hands of each subscriber be revised from hour to hour, there would be no need for the information operator. But the directory cannot at one time list all subscribers. Even during its printing and binding, thousands of changes take place in the telephone community. New subscribers are added to the list. Old ones move their places of business or of residence.

Though their names are not listed on the directory, these subscribers must be connected by the highways of speech with all others in the community. To supplement the printed page, there must be guides at the crossroads of conversation.

Such are the information operators, selected for their task because of quickness and accuracy, courtesy and intelligence. At their desks, connected with the switchboards in central offices, they relieve the regular operators from answering thousands of questions about telephone numbers that would otherwise impede the rendering of service. If they are asked for numbers already in the directory, service is retarded.

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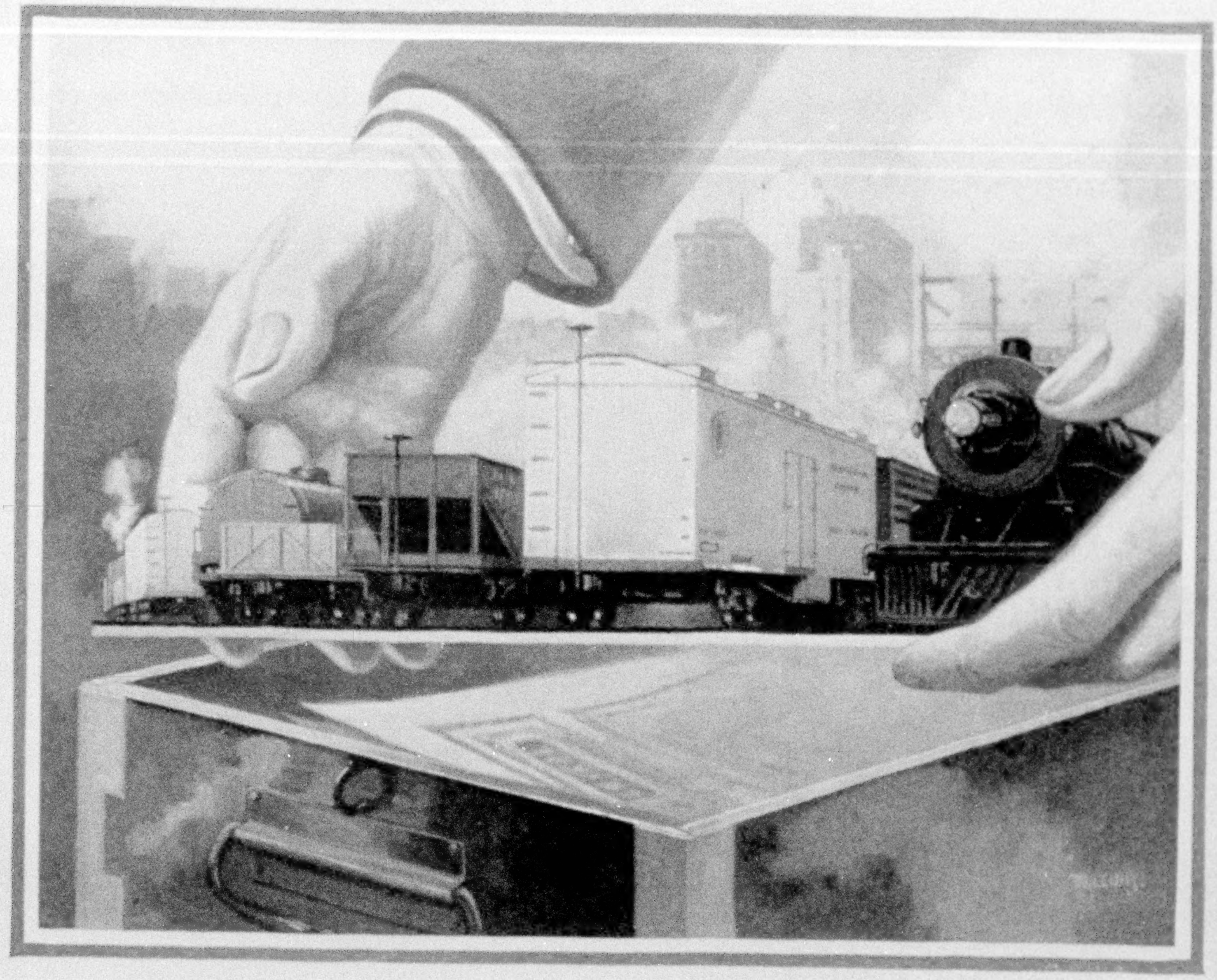

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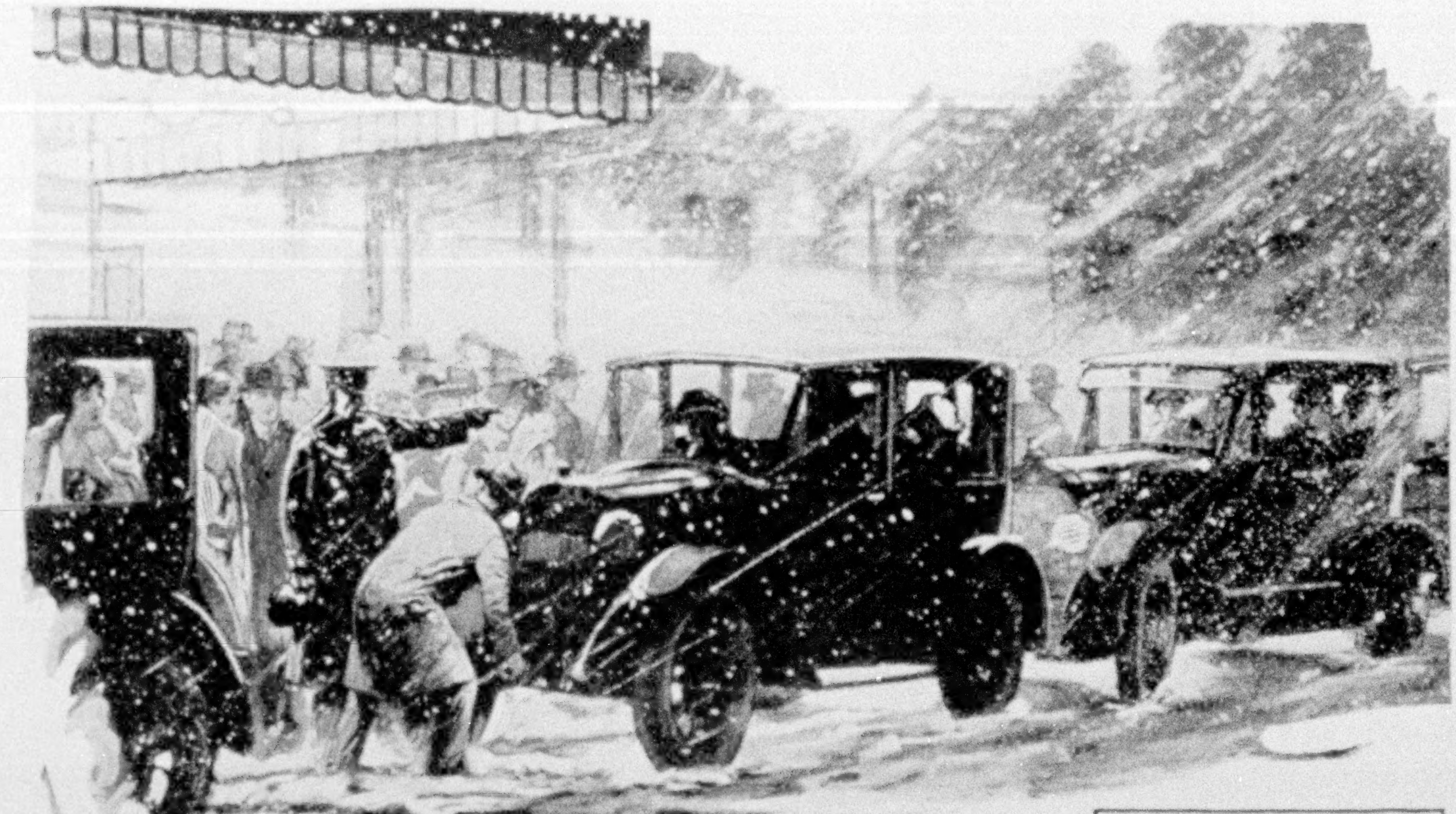

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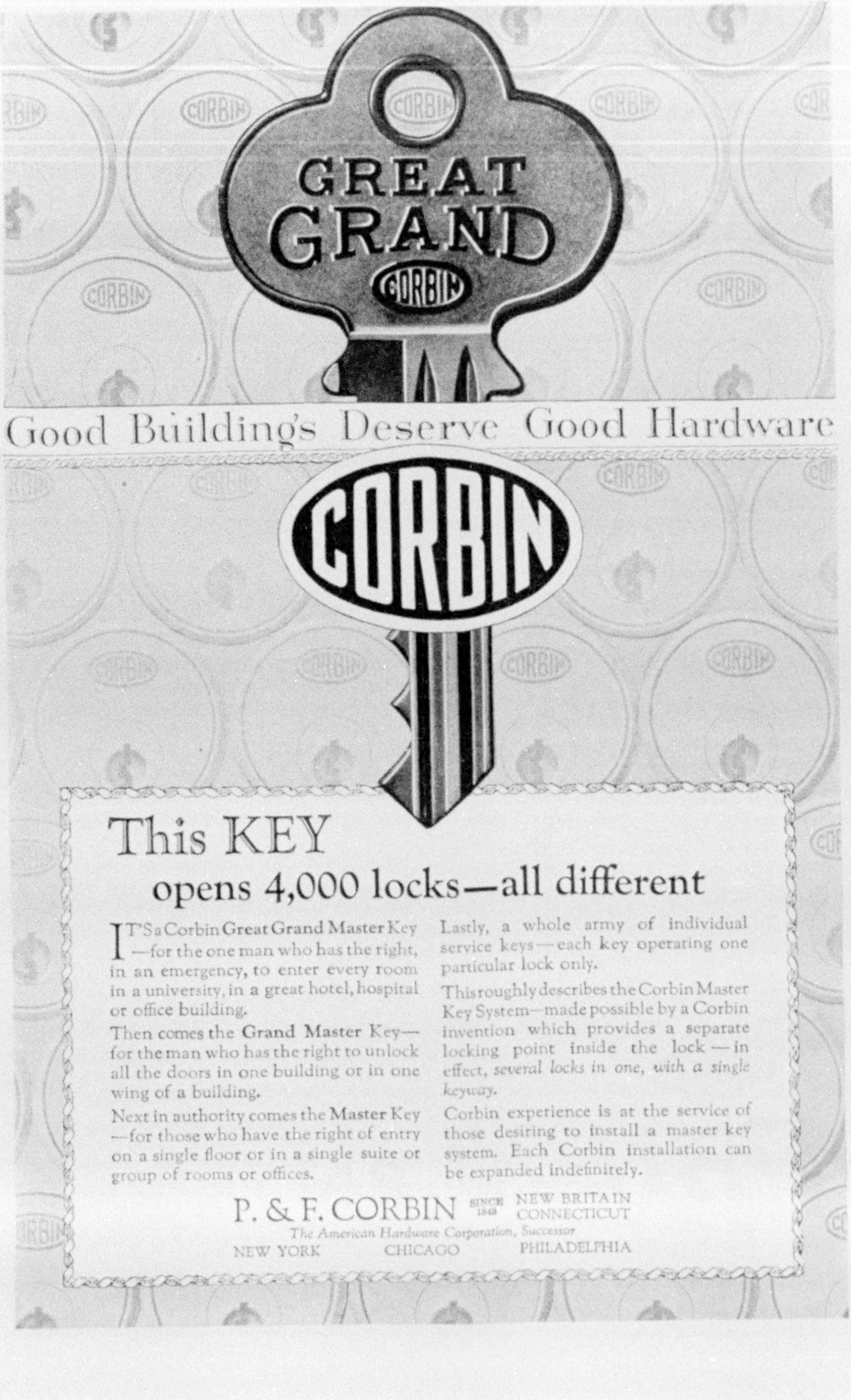

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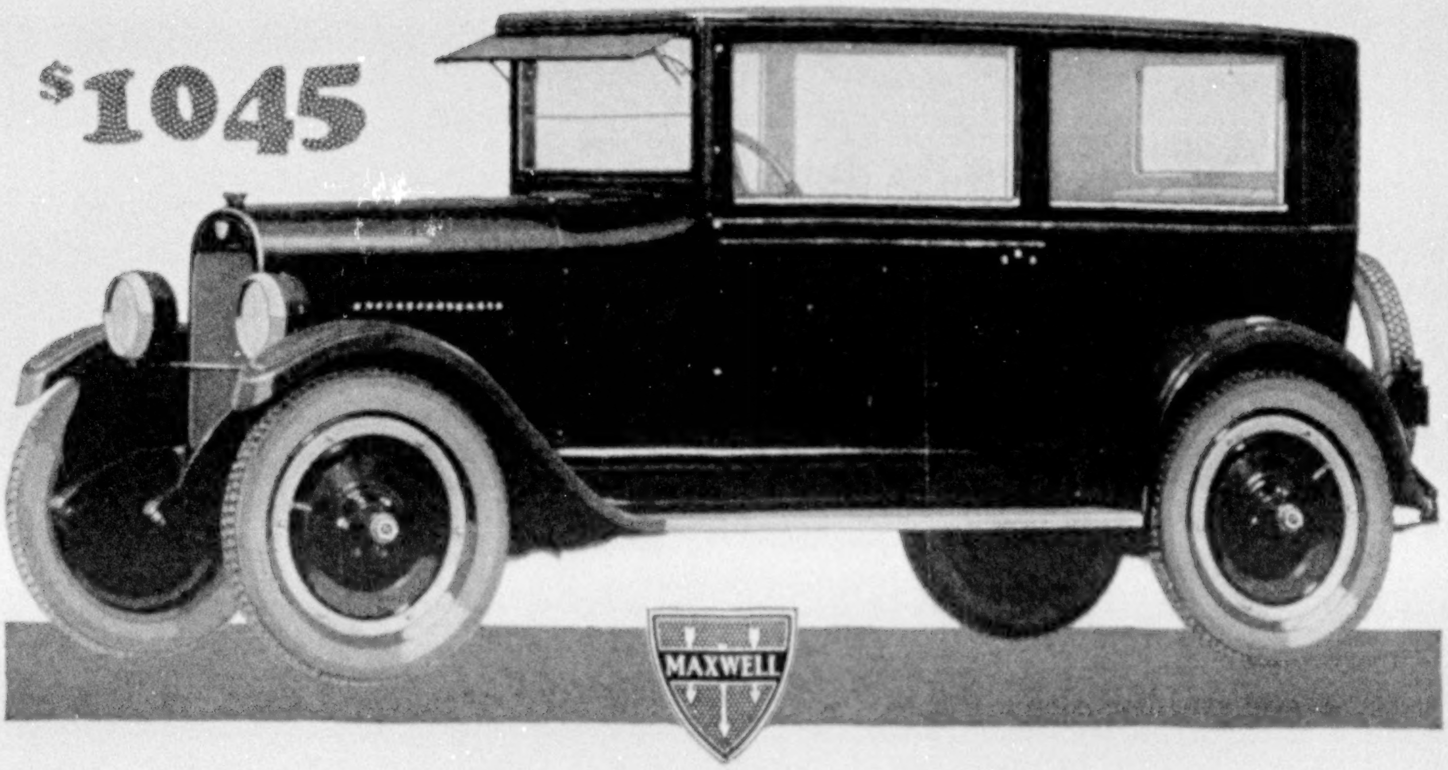

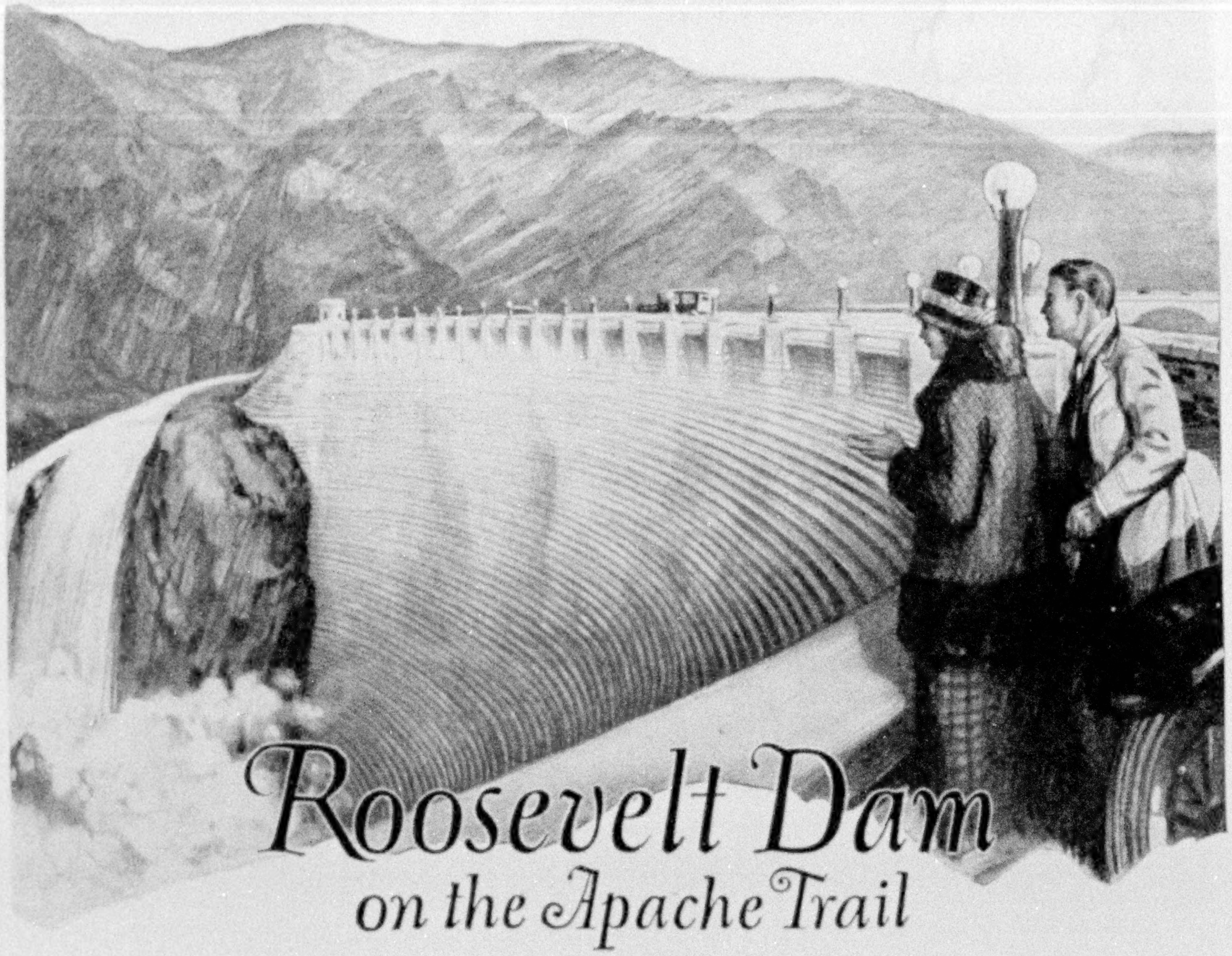

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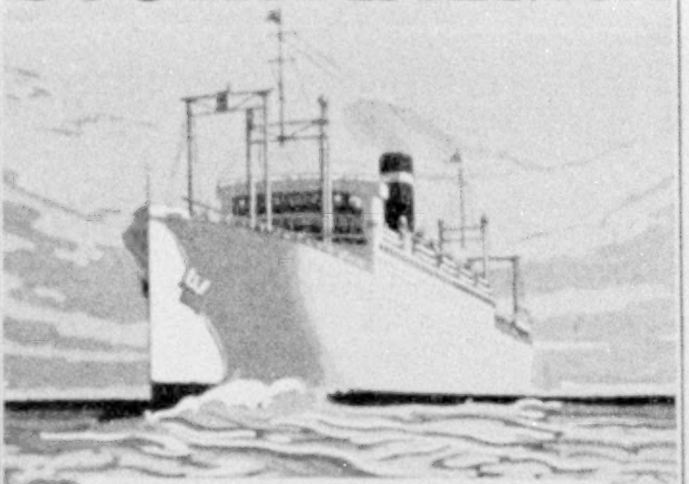

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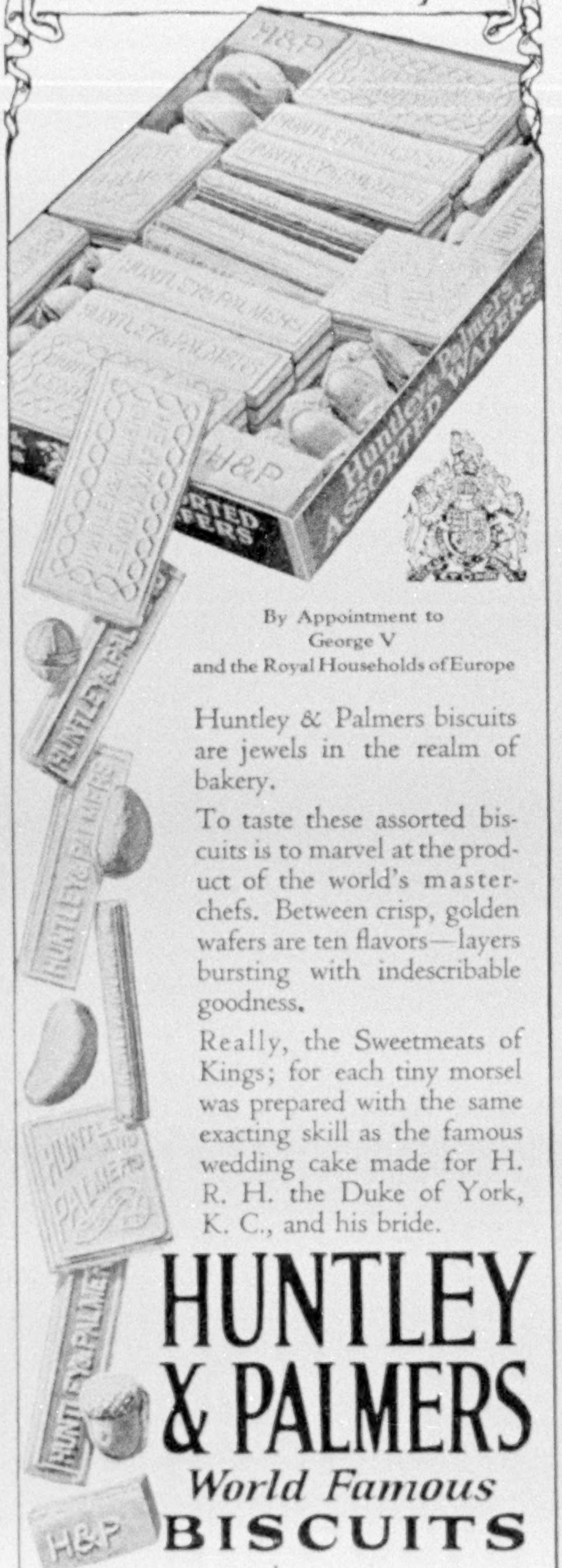

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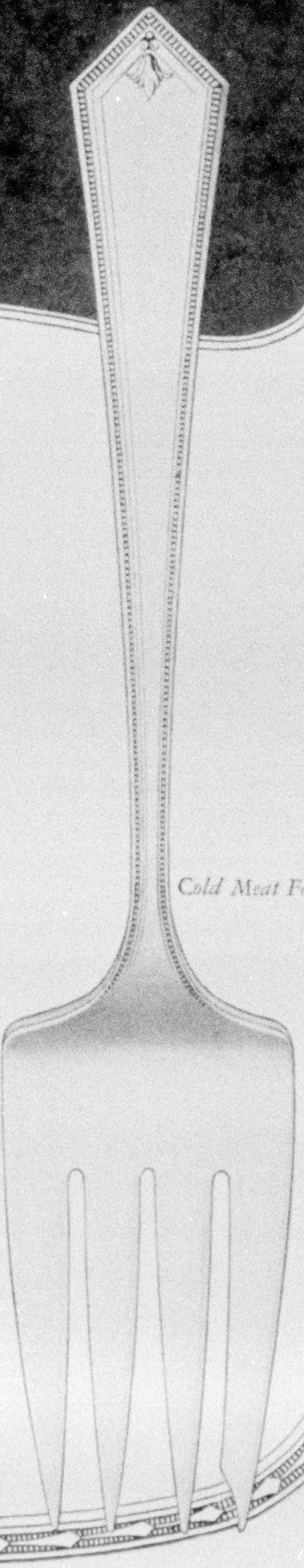

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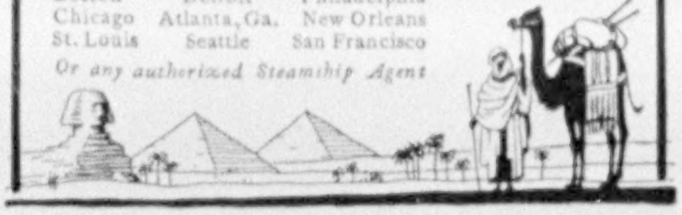

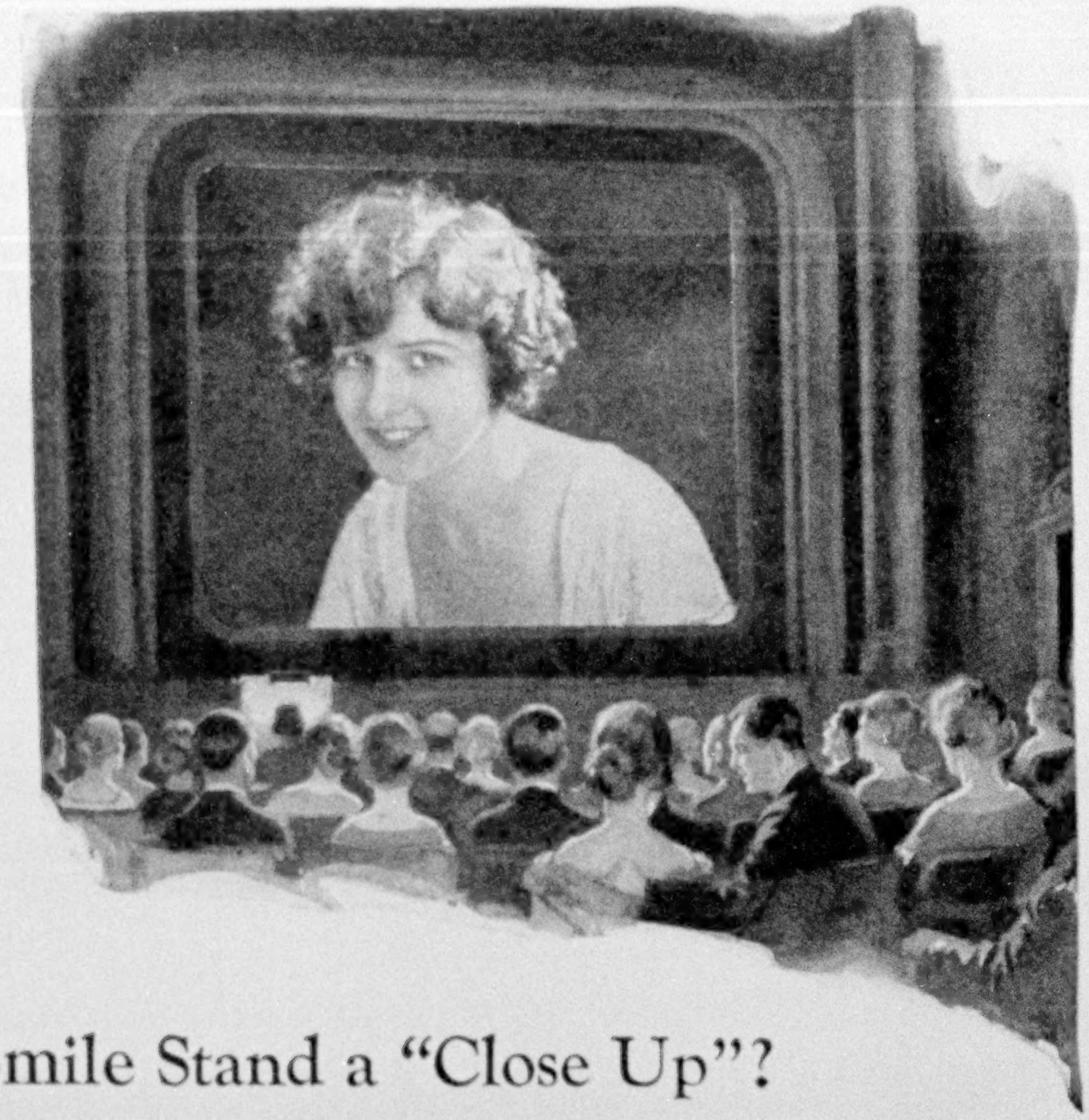

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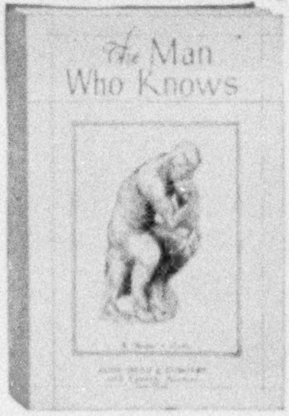

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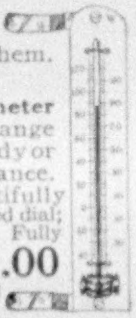

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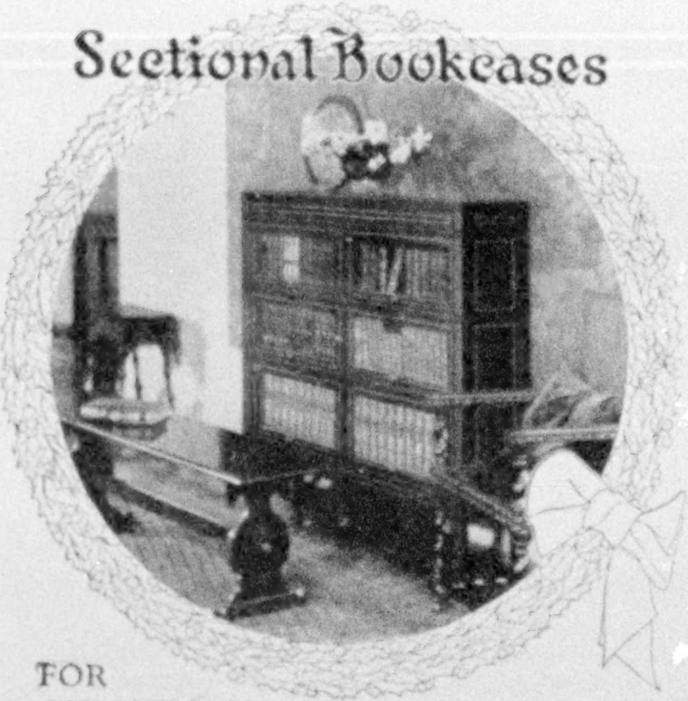

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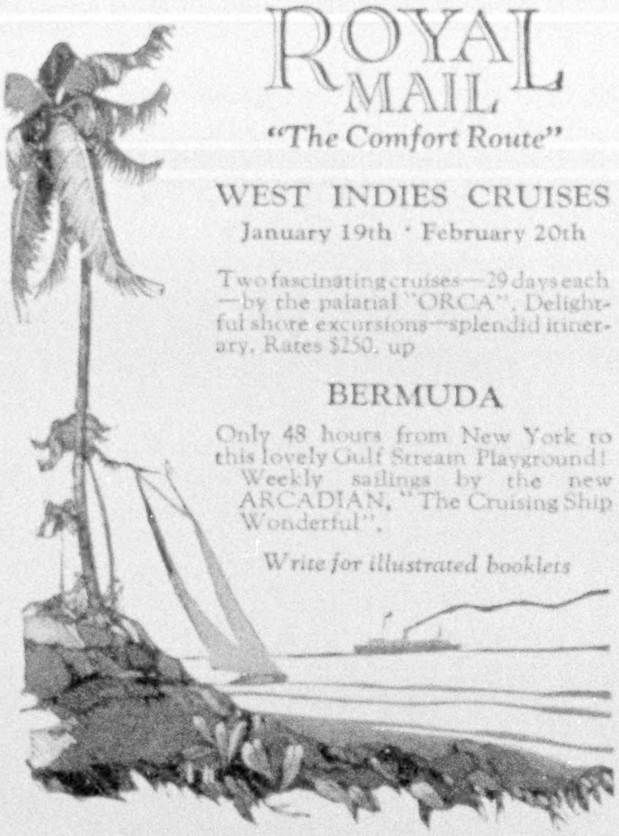

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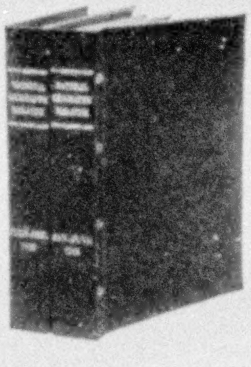

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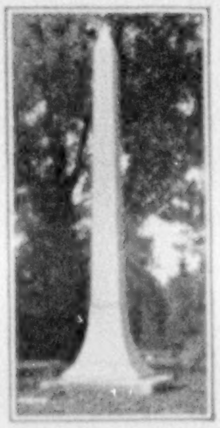

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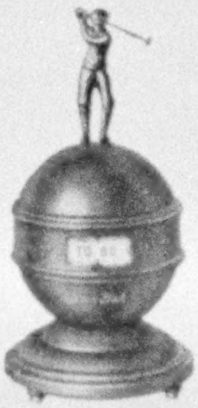

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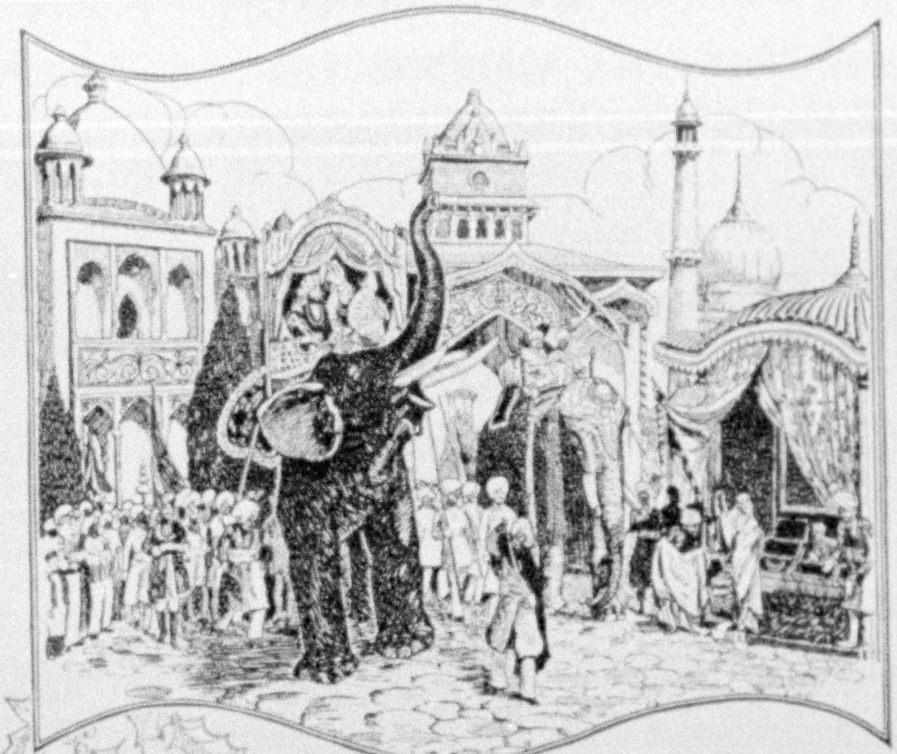

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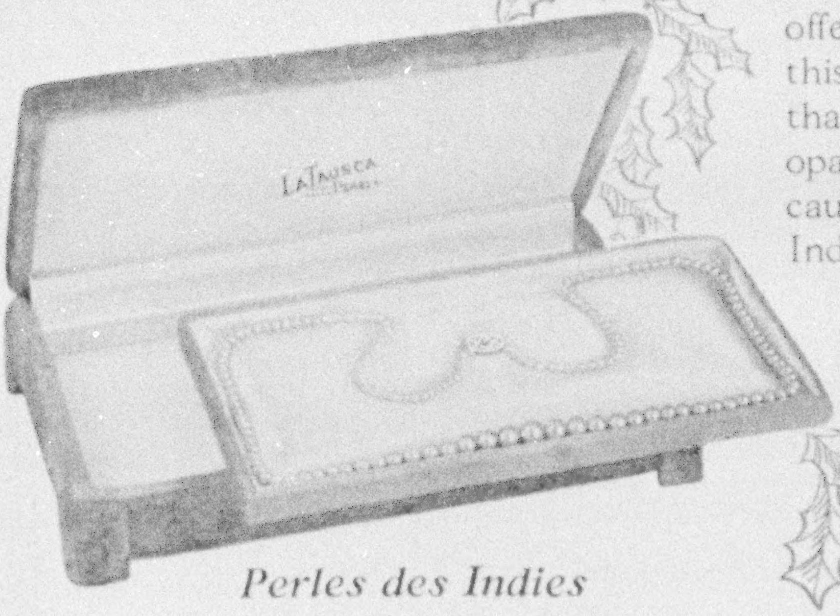

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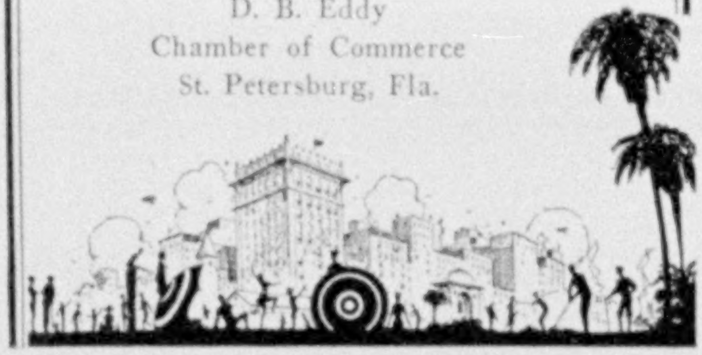

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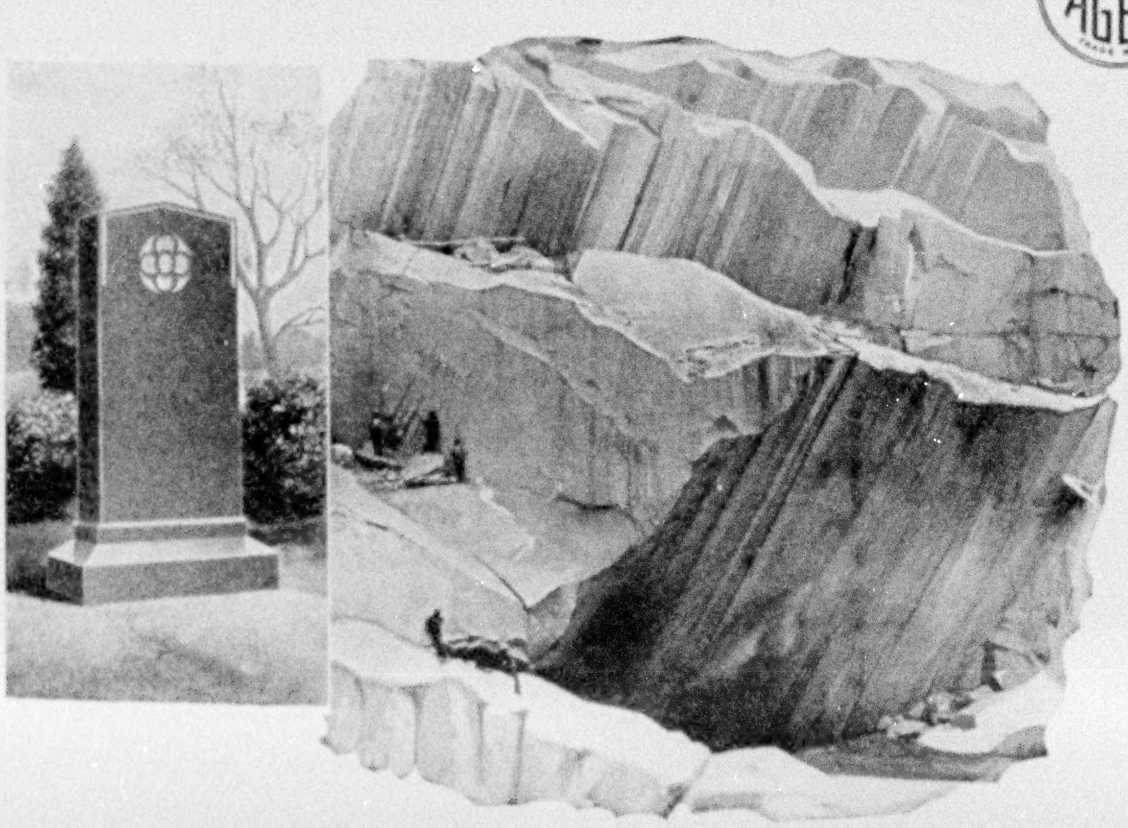

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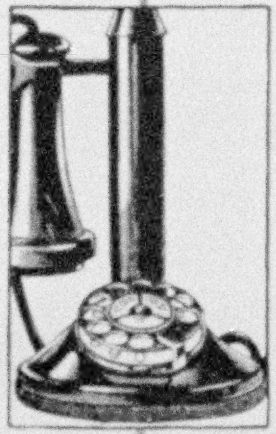

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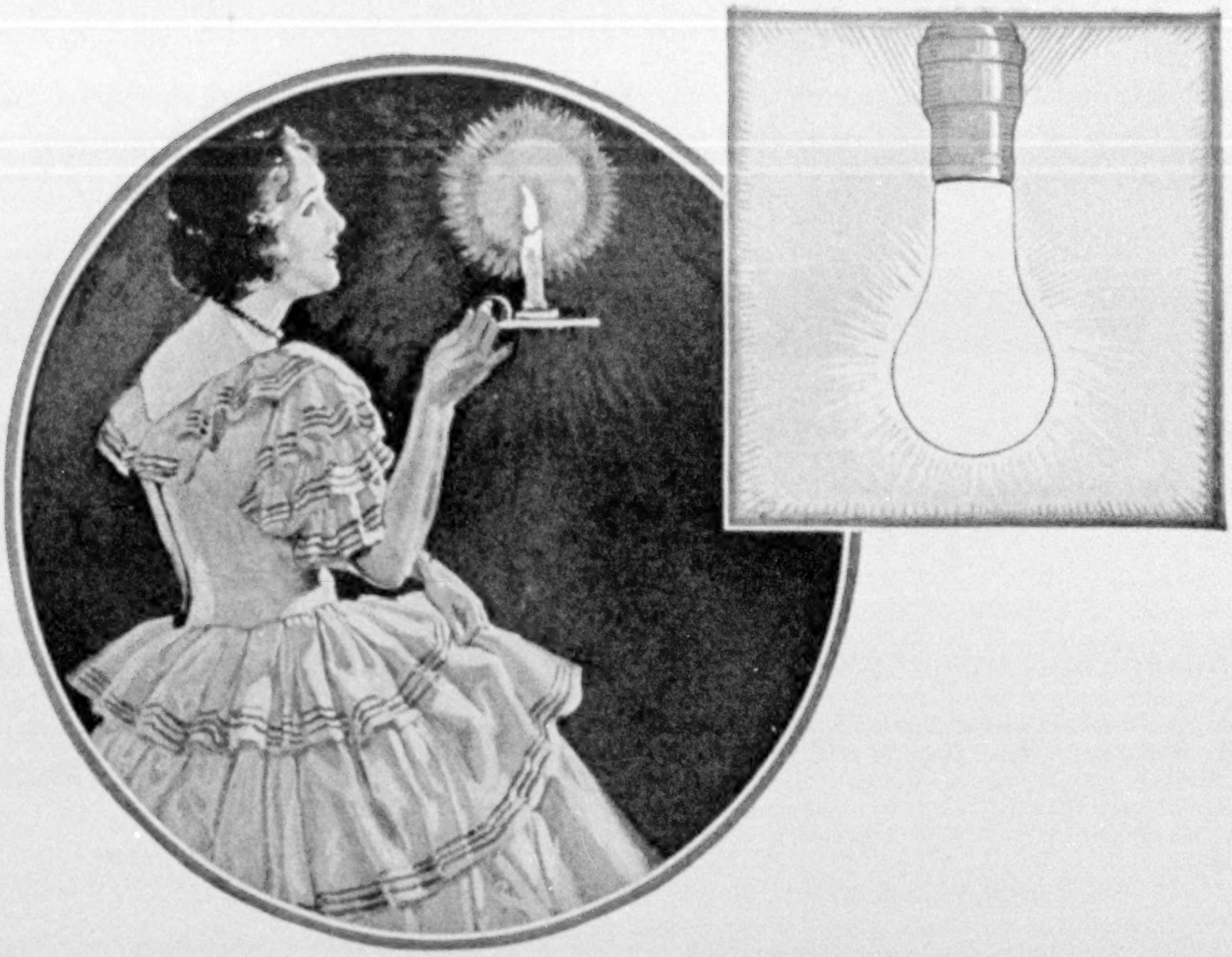

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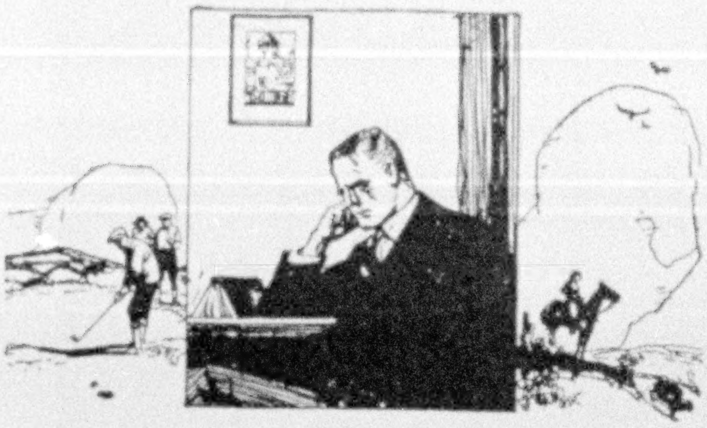

When Benj. Lowe came to himself

The doctor shook his head.

Lowe started. He had been out of sorts lately. Couldn't sleep. Nothing agreed with him. He knew he was not himself.

That night, for the first time in his hard-working, rushing life, Lowe came to himself. No vacations for ten years. Heavy responsibilities. Making money? Yes. Now on the verge of breakdown. What was it all worth, anyway?

And then his eyes fell on a booklet his worried wife had sent for. It was "Man-Building in the Sunshine-Climate." Idly, Lowe glanced at it, then a paragraph caught his attention.

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"Straight from the shoulder, that," thought Lowe. "Present their own citizens as evidence. That's enough for me."

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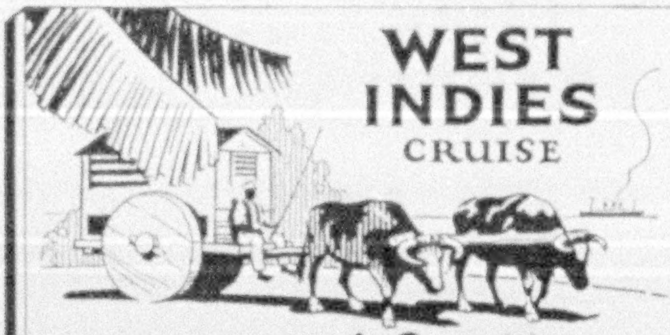

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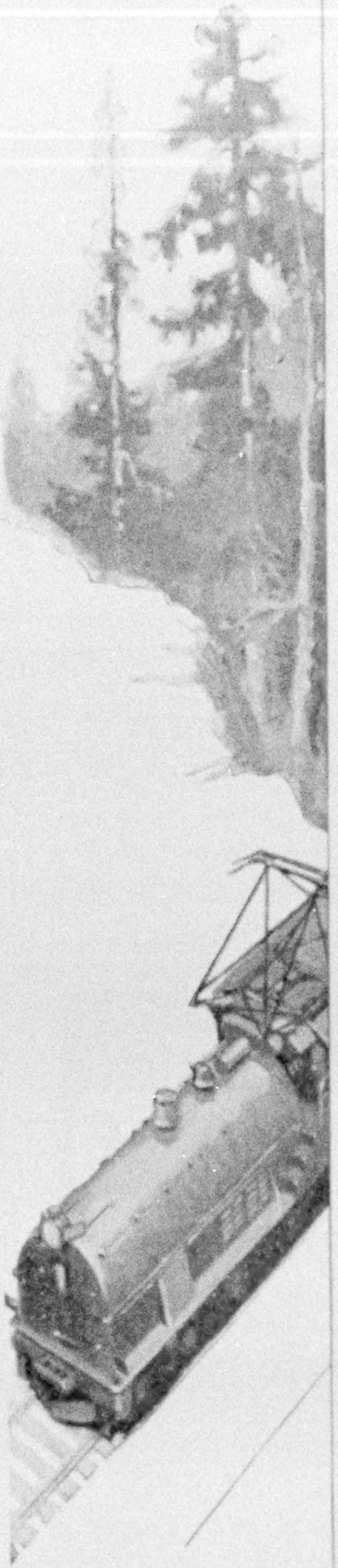

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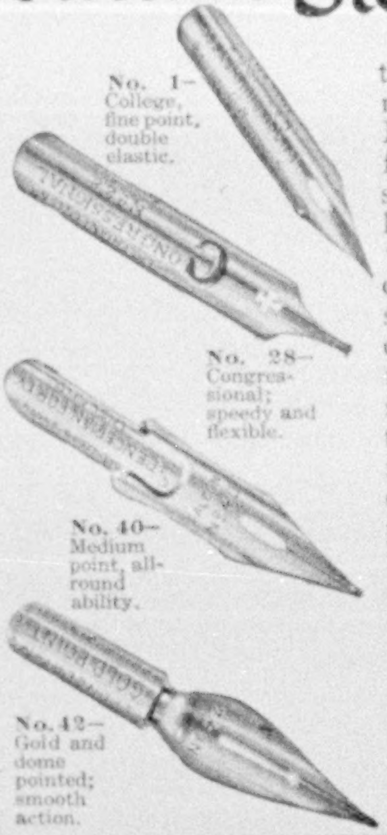
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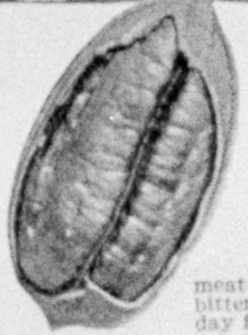

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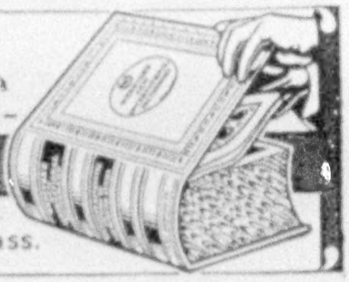

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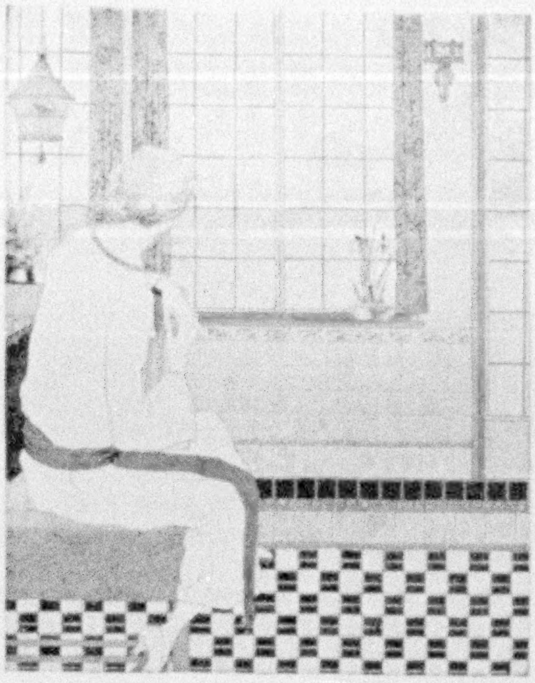

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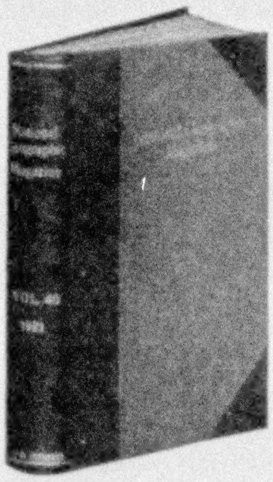

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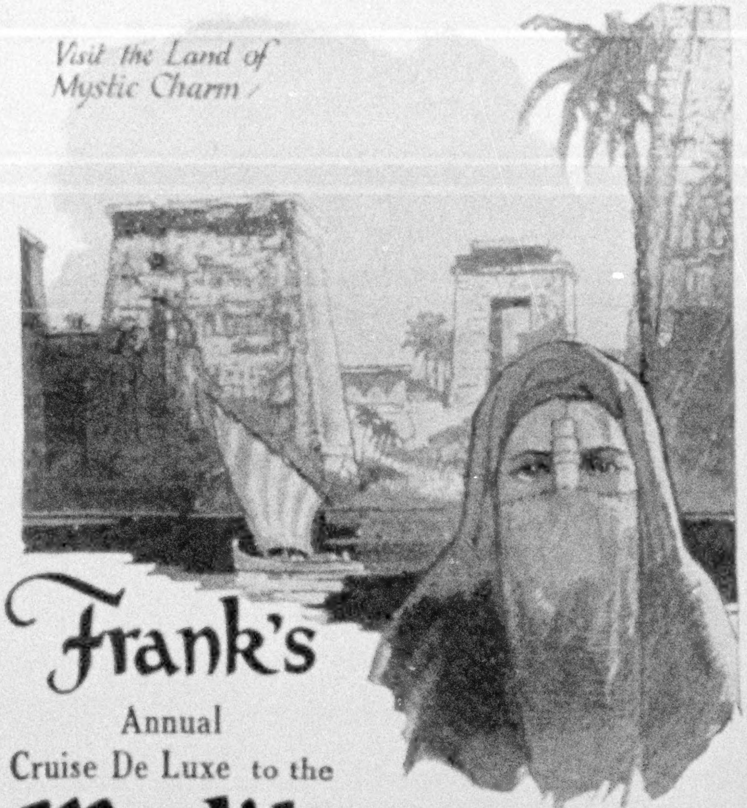
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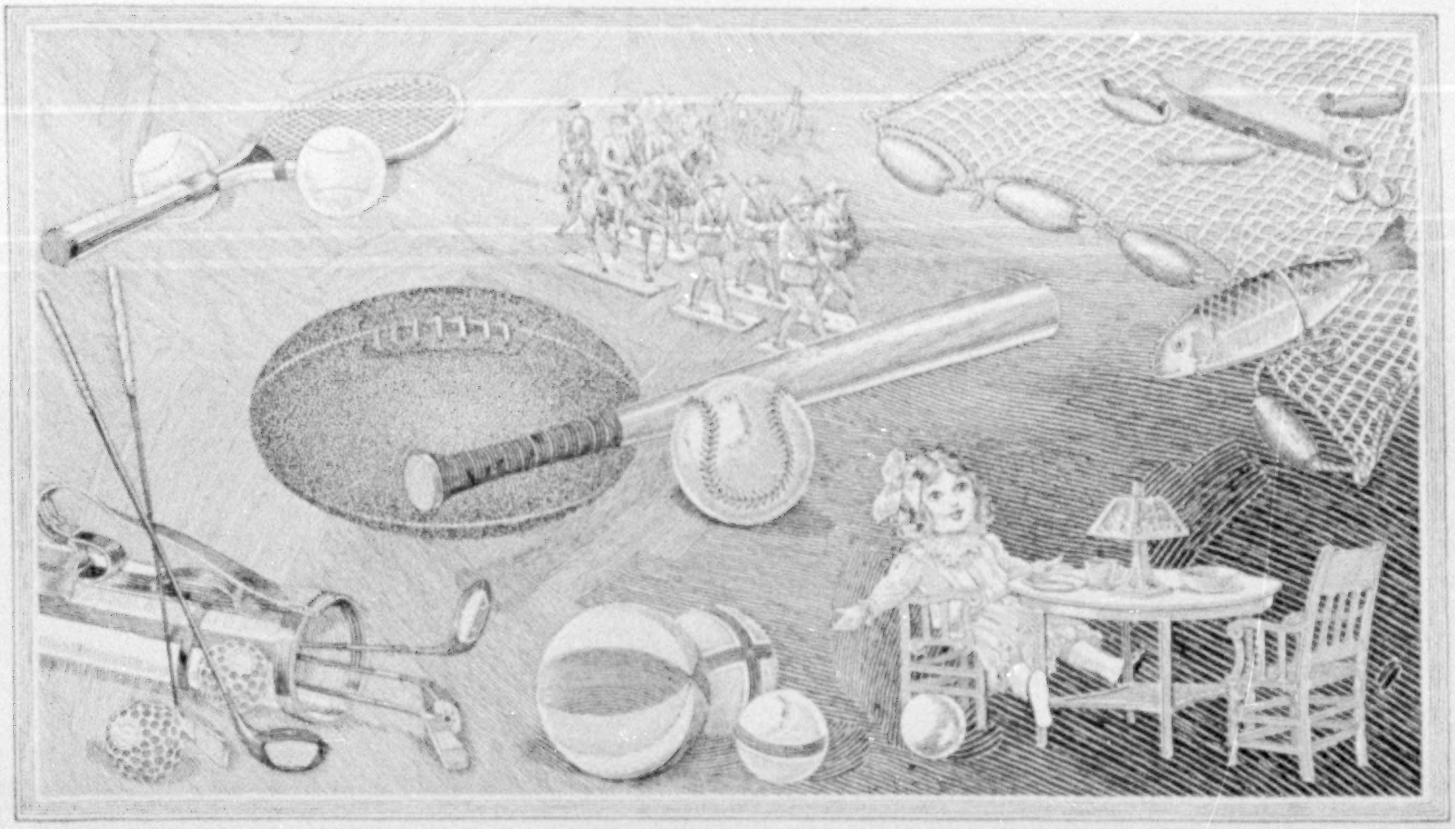


Lead takes part in many games

LEAD whistles back and forth in every play on the baseball diamond. It is at the bottom of every football scrimmage. It leaps back and forth across the tennis net. Lead influences every stroke the golfer takes, and is the fisherman's helper in making his catch.

How lead gets into these sports

Wherever toughness is required in rubber, lead is added to it. Thus lead in the form of litharge—or red-lead, that other lead oxide—is in the rubber core which is in every high-grade baseball. It helps to make the rubber bladders of footballs and basketballs, and is in tennis and other rubber balls.

Lead is also in many baseball bats and in the heads of wooden golf clubs, because it adds weight and helps to balance them. Pulverized lead is used in some golf balls to give them the necessary weight.

Lead helps the fisherman

Lead sinkers are used in fishing to carry the hook down to the desired depth. The heavy weight of lead for its bulk makes it the proper metal to use. And it will not rust.

This metal often covers the shanks of fish-hooks and weights down large fishing nets.

Lead in the nursery

The little boy's eyes shine with excitement as he takes his new lead soldiers out of the box on Christmas Day. Made of lead, they will not rust or mold as did the toy soldier of Field's "Little Boy Blue."

His sister peacefully plays with her new dolls with their lead-weighted eyes and her miniature furniture and other toys often made of lead. Toy-makers use lead extensively because it can be easily shaped and moulded into many forms.

"Save the surface and you save all"—Paint & Varnish

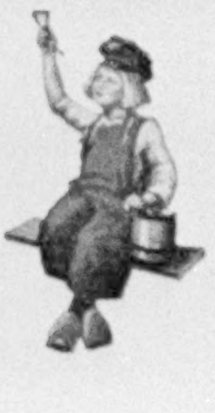
Lead for preservation

Despite the widespread use of lead in the sport and play of the world, perhaps it is in preserving and beautifying buildings, inside and out, that lead performs its most useful service. Dryness and decay deface and destroy. But white-lead paint protects from the ravages of weather.

It is false economy to put off painting houses until deterioration makes expensive repairs necessary. Hence, property owners are heeding the warning, "Save the surface and you save all."

The professional painter, careful of his reputation, uses what he calls "lead-in-oil," a mixture of pure white-lead and pure linseed oil, for outside work. He uses white-lead and flatting oil, with coloring matter added, to make a smooth, beautiful paint of any color, for interior work.

Look for the Dutch Boy



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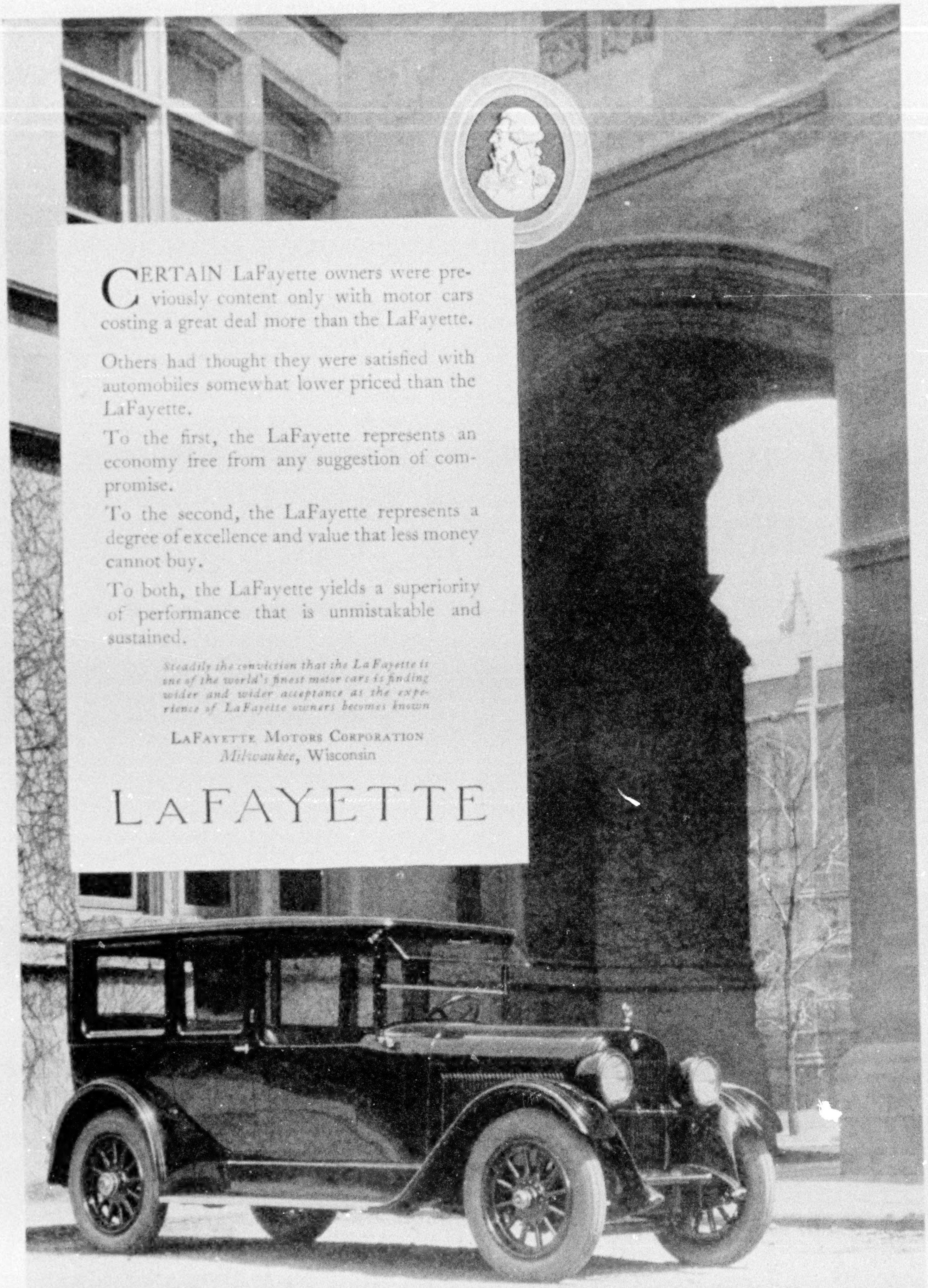

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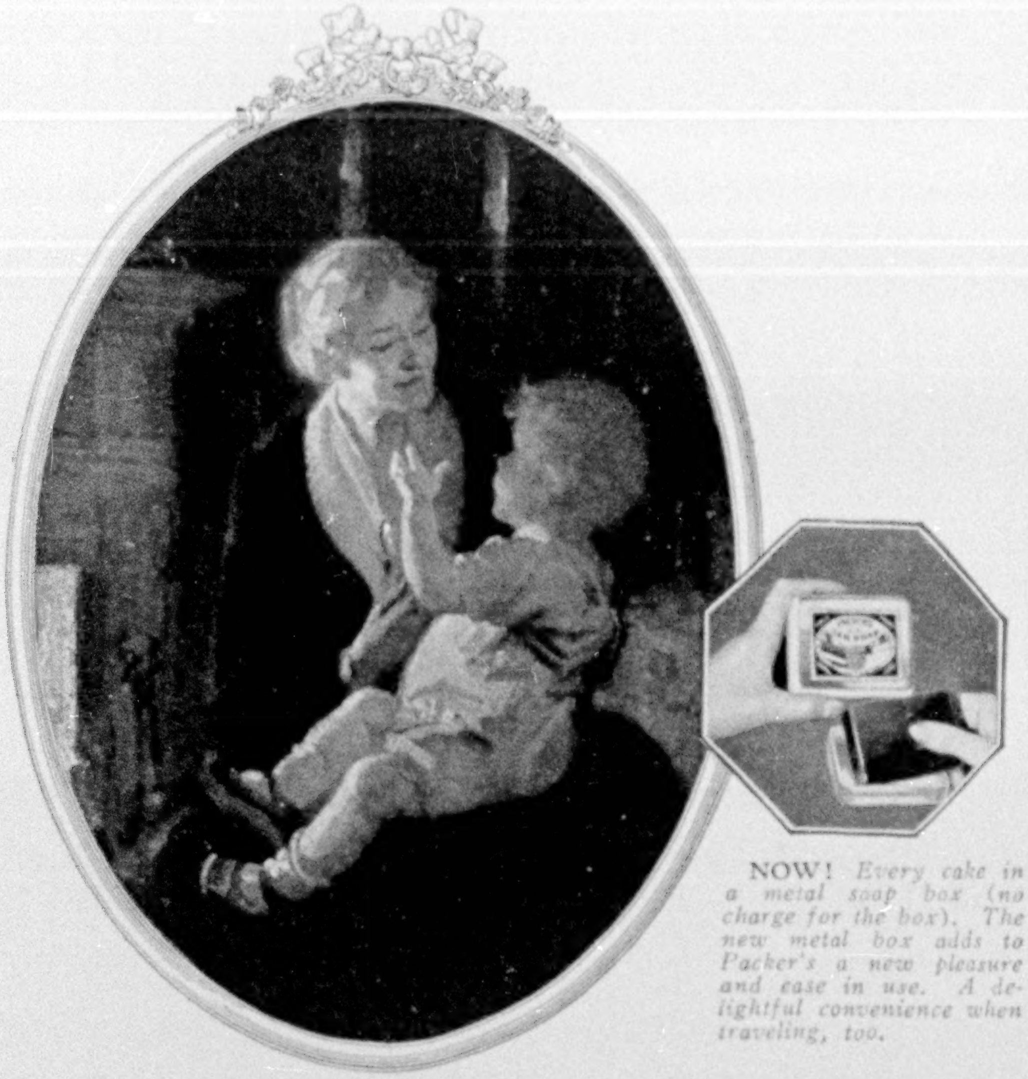
LAFAYETTE

Among maturity's charms, what is more gracious than well-cared-for gray hair?



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What does nature do when she turns hair gray?

HAIR owes its varied colors chiefly to differing amounts of pigment (coloring matter). With the years, nature eliminates this coloring matter and so gray hair is largely due simply to an absence of coloring matter.

Gray hair, however, may be made one of maturity's greatest charms provided, of course, it receives proper, thoughtful care.

And what is proper care for gray hair, or blond or dark hair, too, for that matter?

Regular shampoos—yes! But even further, regular shampoos with a beneficial preparation.

When you shampoo with Packer's Tar Soap or Packer's Liquid Shampoo, as directed, you may anticipate a two-fold reward—hair loveliness today and hair health tomorrow.

Quickly Improves Appearance! Future Hair Health!

Because Packer's cleanses *thoroughly* it brings to you immediate pleasure in hair which fluffs up charmingly into a lustrous, luxuriant-looking mass. Soft and fluffy, now, your hair may be arranged at its loveliest.

You should continue to use Packer's regularly! For its continued use encourages a normal flow of natural oil. And a normal flow of oil guards against dry and brittle or too oily hair.

The healthful pine-tar as incorporated in Packer's Tar Soap finds its way into the pores of the scalp. Thoroughly cleansed and stimulated by its Packer shampoo, the glowing scalp supplies a continual flow of nourishment to the hair.

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Physicians recommend pine-tar as a healthful, beneficial shampoo ingredient. Packer's (either cake or liquid) gives a creamy lather which coaxes out the glints of natural color—that elusive charm of the hair which lends beauty even to plain features. We recommend Packer shampoos especially to maintain the golden sheen of blond hair.

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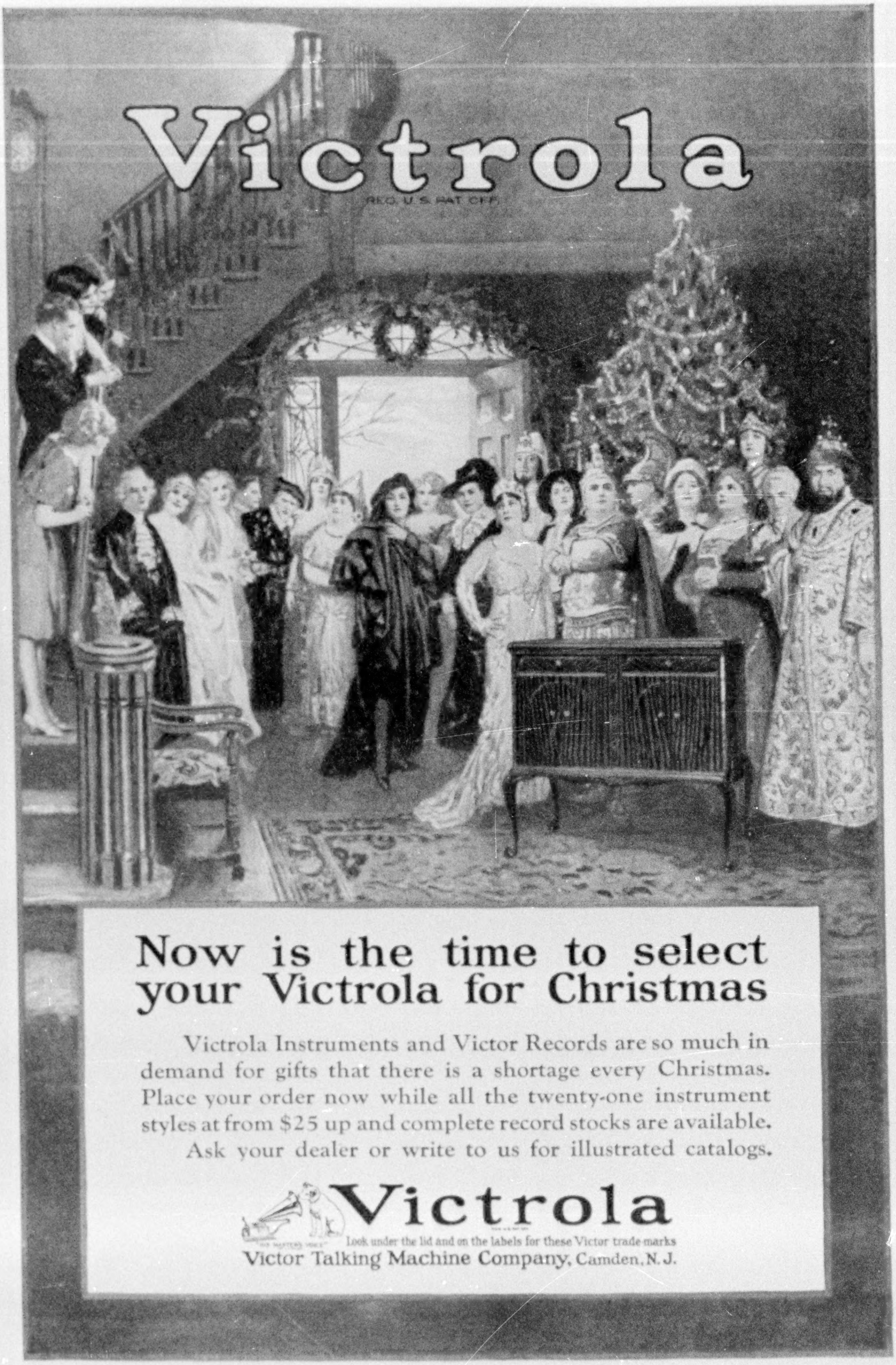

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